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MX SITING INVESTIGATION

WATER RESOURCES PROGRAM

INDUSTRY ACTIVITY INVENTORY,

NEVADA-UTAH

Prepared for:

U. S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

02 September 1980

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Water use within the MX siting area is estimated [illegible] acre-feet per year. Irrigation agriculture, the largest consumer, uses 827,000 acre-feet, while mining and energy-related industry uses [illegible] 65,000 acre-feet, [illegible]

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FOREWORD

This report was prepared as part of the MX Water Resources Program for the Ballistic Missile Office (BMO) in compliance with Contract No. F04704-80-C-0006, CDRL Item 004A2. It presents a summary of the water-use inventory for industry activities in the Nevada-Utah siting area. Also included, as Appendices A and B, are the complete industry activity reports of the Desert Research Institute and the Utah Water Research Laboratory which were conducted under the direction of Fugro National, Inc.

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1.0 INTRODUCTION

Available supplies of surface and ground water in the arid areas of western Utah and Nevada are already largely allocated for beneficial use. In addition to the proposed MX missile system, major developments in mining and the conversion of fossil fuels to electrical energy are proposed or currently being studied in the area. Each of these proposed developments will require substantial quantities of water and will compete for the remaining supply that is available.

An initial task in defining the availability of water for the MX missile system is to inventory all current water users in the area, determine their water demands, and estimate possible future industrial activities and their associated water requirements. An inventory of current water use along with an assessment of possible future demands within the Nevada-Utah siting area were initiated in the fall of 1979. The study was conducted for Fugro National by the Desert Research Institute (DRI) in Nevada and the Utah Water Research Laboratory (UWRL) in Utah. A summary of the results and conclusions of these studies are presented in this report; copies of the subcontractors' complete reports are included in Appendices A and B.

Water demands were evaluated in conformance with the following four major water-use categories:

1. Irrigation of cropland;
2. Livestock watering;
3. Mining and Energy - including mining, milling, power generation, and oil extraction; and

4. Urban/Industrial - including all industrial and commercial activities in urban areas.

Water use was estimated in accordance with both present and possible future requirements for each of 64 valley areas within the Nevada-Utah siting area.

2.0 SUMMARY OF RESULTS AND CONCLUSIONS

Results of the water-use inventories are summarized in Table 1 for both the present water use within the MX siting area and potential future demands. The table shows that present water use in the siting area is estimated to be about 909,000 acre-feet per year (af/yr), with the largest portion of those water demands being used for irrigated agriculture (827,000 af/yr). Mining and energy-related uses represent the second largest water use, and, at present, their demands total about 65,000 af/yr.

Estimating future water demands within the siting area was also included as part of the water-use inventories. Mining- and energy-related water uses were found to represent the only industrial activity with the potential for substantial increases in demands for the near term. The potential exists for new mining activity, as well as reviving past mining sites. New and revived mining activities and the cooling needs of possible new coal-fired electric power plants represent the chief competitors with MX for the available water. Estimated future demands for mining- and energy-related users are also shown in Table 1. Their combined future water demands total about 297,000 af/yr which is 232,000 af/yr greater than the present demands. The potential increase in water use for mining and energy represents an increase in total water demands in the study area of 25 percent.

HYDROGRAPHIC BASIN *	PRESENT (AF/YR)					FUTURE (AF/YR)
	Irrigation	Livestock	Mining & Energy	Urban/ Industrial	Valley Total	Potential Mining & Energy
			NEVADA			
Alkali Spring	--	9	227	80	316	1,837
Antelope	950	48	--	--	998	
Big Smoky (North)	20,268	54	1,643	--	21,965	
Big Smoky (South)	4,140	41	26,172	270	30,623	
Cave	1,000	11	--	--	1,011	
Clayton	192	15	13,081	--	13,288	16,623
Clover	900	--	269	585	1,754	
Coal	--	15	--	--	15	
Delamar	--	44	--	--	44	
Diamond	70,300	78	845	32	71,255	885
Dry Lake	--	21	--	--	21	
Dry	3,300	14	--	--	3,314	
Eagle	1,500	1	--	--	1,501	
Garden	250	30	--	--	280	
Hamlin	1,500	15	--	--	1,515	
Hot Creek	570	62	129	--	761	250
Kane Springs	--	4	--	--	4	
Kobeh	3,240	100	--	--	3,340	
Lake	18,200	30	--	--	18,230	
Lida	184	16	3	--	203	
Little Fish Lake	456	30	--	--	486	
Little Smoky (North)	3,230	40	40	--	3,310	
Little Smoky (Central)	--	1	--	--	1	
Little Smoky (South)	--	11	--	--	11	
Lower Meadow	4,500	38	--	--	4,538	
Monitor (South)	4,202	11	338	--	4,551	5,635
Newark	6,900	79	40	--	7,019	
Pahranagat	15,600	16	--	198	15,814	
Pahroc	--	20	--	--	20	
Panaca	6,900	15	968	210	8,093	
Patterson	--	56	322	94	472	
Penoyer	3,000	22	9,451	--	12,473	
Pleasant	450	1	--	--	451	
Railroad (North)	11,880	92	242	--	12,214	
Railroad (South)	--	24	161	--	185	
Ralston	760	6	--	--	766	
Rose	1,050	1	--	--	1,051	
Sarcobatus Flat	608	16	--	--	624	
Spring [1]	16,405	205	1,731	--	18,341	1,932
Spring [2]	4,200	54	--	--	4,254	
Steptoe	19,500	121	9,604	2,872	32,097	34,694
Stevens	--	2	--	--	2	
Stone Cabin	1,425	37	40	--	1,502	80
Stonewall Flat	--	6	--	--	6	
Tikapoo	--	9	--	--	9	
White River	20,000	109	--	--	20,109	
Unknown						15,000

SUMMARY OF PRESENT AND PROJECTED FUTURE INDUSTRY ACTIVITIES AND WATER USE

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE 1
1 OF 2

FUGRO NATIONAL, INC.

HYDROGRAPHIC BASIN *	PRESENT (AF/YR)					FUTURE (AF/YR)
	Irrigation	Livestock	Mining & Energy	Urban/ Industrial	Valley Total	Potential Mining & Energy
			UTAH			
Beaver	26,950	53	--	5,920	32,923	
Cedar	28,490	67	18	372	28,947	5,528
Deep Creek	2,800	21	--	--	2,821	
Dugway	3,800	11	--	2,375[3]	6,186	
East	--	12	--	--	12	
Escalante (South)	82,163	21	--	--	82,184	16,530
Fish Springs Flat	--	20	4	--	24	30,850
Government Creek	1,750	7	--	1	1,758	
Hamlin	640	18	--	--	658	
Milford-Minersville	48,650	77	--	76	48,803	28,768
Pavant	102,182	96	--	265	102,543	61,700
Pine	--	47	--	--	47	8,000
Sevier Desert[4]	249,820	208	--	242	250,270	33,000
Snake[5]	30,888	74	--	--	30,962	27,550
Tintic	1,330	39	2	1	1,372	
Tule	--	33	--	--	33	
Wah Wah	--	52	--	--	52	8,212
Whirlwind	--	28	--	--	28	
TOTAL	827,223	2,514	65,330	13,593	908,660	297,074

1. State hydrologic basin 184, located in White Pine County, Nevada.
2. State hydrologic basin 201, located in Lincoln County, Nevada.
3. Includes 2375 acre-feet per year used by military facilities.
4. An additional 2047 acre-feet per year has already been appropriated for future mining and industry activities.
5. Includes that portion of Snake Valley located in Nevada.

* The hydrographic basin names used for compilation of water-use estimates by the Desert Research Institute were delineated by the states' engineers office in Nevada and Utah based on surface-water flow patterns. Valley names used by Fugro National are geographic place names which generally correspond in part or in total to the same area as the hydrographic names. However, there are several notable exceptions. Examples of these nomenclature differences for equivalent areas are listed below.

Hydrographic Basin(s)	Geographic Valley(s)
Big Smoky (South)	Big Smoky
Dry Lake	Dry Lake and Muleshoe
Lake and Patterson	Lake
Little Smoky (North) and (Central)	Little Smoky
Little Smoky (South)	Big Sand Springs
parts of Hot Creek and Railroad (South)	Reveille

SUMMARY OF PRESENT AND PROJECTED FUTURE INDUSTRY ACTIVITIES AND WATER USE

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE 1
2 OF 2

FUGRO NATIONAL, INC.

The study found that much of the available water supply in the area is already allocated, however, some valley areas are still capable of sustaining additional ground-water development. State regulatory agencies will assess and approve each water-use proposal as they are presented. In general, energy and industrial activities are located near cities and away from planned construction locations.

Mining-related water is developed on-site in the mountains or high on alluvial fans. Since agricultural development is primarily in the central valley areas, the reduction of piezometric heads from a major ground-water extraction program would have the greatest potential impact on these water users.

Although many past mining operations are currently inactive, the potential exists for reviving many of these operations as society's demand for minerals from these areas increases. The largest volume of water consumed by a single mine operation is the Anaconda Nevada Molybdenum Project which is presently under construction in Big Smoky Valley. It's water demands are approximately 20,000 af/yr. The potential exists for additional mining operations requiring a combined total of about 16,000 af/yr in Pine Valley and Wah Wah Valley.

Preliminary studies are well underway for the development of major coal-fired electric power production facilities throughout the study area. In Nevada, the White Pine Power Project is a planned 1500-MW electric power generating facility for the Ely region. A specific site has not yet been selected. Of the

eight possible sites, five are within the MX siting area, with three of those classified as "most likely." The Sierra Pacific Power Company is considering three possible sites within the MX siting area, however, the potential location of those plants has not been identified. There is an "extremely low probability" that one of the Sierra Pacific sites will be selected within the next ten years. Water demands for the White Pine Power Project and Sierra Pacific facility would total about 40,000 af/yr.

In Utah, a total of five zones are under consideration for potential coal-fired electric power production sites. The areas that would be impacted by these facilities are: Southern Escalante Valley, Cedar Valley, Milford-Minersville Flats, Snake Valley, Fish Springs Flat, Pavant Valley, and Sevier Valley. Total water demands for these potential facilities are 203,900 af/yr. It should be emphasized that these are potential sites and the final construction of all proposals may never occur. Currently, the only planned facility is in the Sevier Desert at a site west of Lynndyl.

Potential geothermal sites are also being investigated within the siting area. However, their water demands are projected to be less than a few hundred acre-feet per year and are not considered to be significant.

Results of the water-use inventories indicate that there is the potential for conflicts in use of the available water resources of the area. If the MX facilities are constructed as planned, it may be necessary to stage construction of any power plants in

the area. Wells drilled for MX missile construction could then be used for power plant cooling when construction of the facilities is completed. It is also possible that water supplies developed by mining or other industrial concerns could be leased by the Air Force for the short (two to three years) duration of construction in a particular ground-water basin.

APPENDIX A

Industry Activity Inventory:
Nevada MX Siting Area

DESERT RESEARCH INSTITUTE
UNIVERSITY OF NEVADA SYSTEM

INDUSTRY ACTIVITY INVENTORY: NEVADA MX SITING AREA

by

G.F. Cochran

J.L. Walker and S. Males

H. Radke and J. Robertson

G.M. Booth

A Report to Fugro National, Inc.

Project No. 79-290-42

Draft - May, 1980

WATER RESOURCES CENTER

INDUSTRY ACTIVITY INVENTORY: NEVADA MX SITING AREA

by

G.F. Cochran[1]
J.L. Walker[2] and S. Males[2]
H. Radke[3] and J. Robertson[3]
and
G.M. Booth[4]

A Report to Fugro National, Inc.
Long Beach, California

Project No. 79-290-42

Draft - May, 1980

[1]Water Resources Center, DRI
[2]Bureau of Business and Economic Research, UNR
[3]Agricultural Consultants
[4]Geothermal Development Associates, Inc.

FOREWORD

Reported herein is an attempt to inventory the economic base for the Nevada MX siting area together with associated water use. The study was restricted to existing activities and near-term future activities that are beyond the preliminary planning stage. Under authorization from Fugro National the geographic scope and thoroughness of the inventory were reduced from that originally contemplated. A portion of the financial resources originally budgeted for this effort were re-directed to an inventory of water rights in the same region.

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SUMMARY AND CONCLUSIONS

Major economic activities within the Nevada MX siting area were inventoried during the period of February to April 1980. The survey was broken down into three major categories as follows:

1. Agriculture - both irrigation and grazing;
2. Mining and Energy - including mining, milling, power generation and oil extraction;
3. Urban/Industrial - including all industrial and commerical activities in the urban areas.

Survey approaches included mail questionaires (2 and 3), field enumeration and personal contacts (1 and 3) and literature review (1,2 and 3). Telephone follow-up was used for non-respondents to the mail questionaires. Particular attention was given to the following areas: Eureka, Ely, Snake Valley, Railroad Valley, White River Valley, Tonopah, Goldfield, Pioche-Caliente, Pahranagat Valley and Coyote-Kane Spring Valley.

The survey included all current activities and "seriously proposed" activities, their location, water use, and employment. Agricultural employment was estimated through use of an Input/Output model developed by the College of Agriculture, University of Nevada, Reno. Employment by economic sector was used to estimate future urban population and water use. The water use and number of activities for the three economic sectors are summarized by hydrographic basin in Table 1.

Given the type of water use in the area and its geographical dispersion there appears little opportunity for significant water transfer between uses or interaction. Most of the mining related water is developed on-site from springs and/or wells, generally either in the mountains or high on the alluvial fans. Water at Kennecott's

TABLE 1.

SUMMARY OF ECONOMIC ACTIVITIES AND WATER USE

		Agriculture				Mining & Energy		Urban/Industrial	[illegible] Totals	
		Irrigation		Grazing						
Basin Name	Basin No.	Acres	Consumpt. Use AF/y	Total AUMs	Water Use AF/y	No. of Facilities	Water Use AF/y	Water Use AF/y	Population	Water Use AF/y
Big Smoky Valley Tonopah Flat	N-137A	2,070	4,140	22,415	41	5	26,172	270	[illegible]	30,623
Big Smoky Valley No. Part	N-137B	11,260	20,268	29,361	54	4	1,643	—	[illegible]	21,965
Kobeh Valley	N-139	1,800	3,240	54,472	100	1	—	—	[illegible]	3,340
Monitor Valley So. Part	N-140B	2,212	4,202	- 8,109	11	4	338	—	[illegible]	4,551
Ralston Valley	N-141	400	760	19,289	6	1	—	—	[illegible]	766
Alkali Spring Vy. (Esmeralda)	N-142	—	—	4,880	9	5	227	80	[illegible]	316
Clayton Valley	N-143	80	192	- 8,260	15	3	13,081	—	[illegible]	13,288
Lida Valley	N-144	80	184	- 8,480	16	2	3	—	[illegible]	203
Stonewall Flat	N-145	—	—	- 3,112	6	—	—	—	—	6
Sarcobatus Flat	N-146	320	608	- 8,744	16	—	—	—	27	624
Cactus Flat	N-148	—	—	- on bombing range	--	1	—	—	—	0
Stone Cabin Valley	N-149	750	1,425	-20,055	37	1	40	—	27	1,502
Little Fish Lake Vy	N-150	240	456	- 600	30	—	—	—	[illegible]	486
Antelope Valley (Eureka & Nye)	N-151	500	950	-26,004	48	—	—	—	[illegible]	998
Stevens Basin	N-152	—	—	910	2	—	—	—	—	879
Diamond Valley	N-153	37,000	70,300	42,439	78	4	845	32	[illegible]	71,255
Newark Valley	N-154	4,600	6,900	43,040	79	1	40	—	[illegible]	7,019
Little Smoky Valley No. Part	N-155A	1,700	3,230	-21,926	40	1 (1)	40 (1)	—	[illegible]	3,310

TABLE 1. (con't.)

SUMMARY OF ECONOMIC ACTIVITIES AND WATER USE

		Agriculture				Mining & Energy		Urban/Industrial	Basin Totals	
		Irrigation		Grazing						
Basin Name	Basin No.	Acres	Consumpt. Use AF/y	Total AUMs	Water Use AF/y	No. of Facilities	Water Use AF/y	Water Use AF/y	Population	Water Use AF/y
Little Smoky Valley (Central Part)	N-155B	--	--	- 774	1	--	--	--	--	1
Little Smoky Valley (So. Part)	N-155C	--	--	- 6,151	11	--	--	--	--	11
Hot Creek	N-156	300	570	-33,508	62	4	129	--	40	761
Tikapoo Valley (No. Part)	N-169A	--	--	- 4,730	9	--	--	--	4	9
Penoyer Vy (Sand Spring Valley)	N-170	1,000	3,000	11,764	22	2	9,451	--	21	12,473
Coal Valley	N-171	--	--	8,292	15	--	--	--	8	15
Garden Valley	N-172	100	250	-16,024	30	--	--	--	17	280
Railroad Valley (So. Part)	N-173A	--	--	-12,963	24	2	161	--	14	185
Railroad Valley (No. Part)	N-173B	6,600	11,880	50,084	92	5	242	--	264	12,214
Steptoe Valley	N-179	13,000	19,500	65,439	121	13	9,604(1)	2,872	8,536	32,097
Cave Valley	N-180	400	1,000	5,700	11	--	--	--	11	1,011
Dry Lake Valley	N-181	--	--	11,299	21	1	--	--	13	21
Delamar Valley	N-182	--	--	-23,707	44	2	--	--	25	44
Lake Valley	N-183	6,500	18,200	-16,478	30	--	--	--	73	18,230
Spring Valley	N-184	9,650	16,405	-111,542	205	3	1,731	--	204	18,341
Pleasant Valley	N-194	300	450	- 676	1	--	--	--	4	451
Snake Valley	N-195	2,500	3,750	-24,360	45	1	483	--	113	4,278

TABLE 1. (con't.)

SUMMARY OF ECONOMIC ACTIVITIES AND WATER USE

Basin Name	Basin No.	Agriculture				Mining & Energy		Urban/Industrial	Basin Totals	
		Irrigation		Grazing						
		Acres	Consumpt. Use AF/y	Total AUMs	Water Use AF/y	No. of Facilities	Water Use AF/y	Water Use AF/y	Population	Water Use AF/y
Hamlin Valley	N-196	50	1,500	- 8,227	15	--	--	--	8	1,515
Dry Valley	N-198	1,100	3,300	- 7,344	14	--	--	--	8	3,314
Rose Valley	N-199	350	1,050	- 165	1	--	--	--	4	1,051
Eagle Valley	N-200	500	1,500	- 235	1	--	--	--	93	1,735
Spring Valley	N-201	1,000	4,200	-29,405	54	--	--	--	48	4,254
Patterson Valley	N-202	--	--	-30,438	56	3	322	94	807	472
Panaca Valley	N-203	2,300	6,900	- 8,115	15	5	968	210	813	8,093
Clover Valley	N-204	300	900	--	--	2	269	585	1,406	1,754
Lower Meadow Vy	N-205	1,500	4,500	-20,805	38	--	--	--	58	4,538
Kane Springs Vy	N-206	--	--	- 2,339	4	--	--	--	2	4
White River Vy	N-207	8,000	20,000	-58,950	109	--(1)	--(1)	--	290	20,109
Pahroc Valley	N-208	--	--	-10,722	20	--	--	--	11	20
Pahranagat Valley	N-209	5,200	15,600	- 8,733	16	1	--	198	595	15,814
TOTAL		124,062	248,860	926,634	1,709	77	65,789	4,341	18,178	324,226

(1) Does not include 20-25,000 Ac-ft/yr. for White Pine Power Project

Horses and burros grazing in 158A not included.

McGill facility is currently also used for urban water supply at McGill.

With regard to grazing, major groundwater development in those basins where springs and/or shallow wells provide stockwater could result in serious problems for the ranchers. While grazing requires little actual water (estimated at about 1,700 ac-ft/yr), the continued existance of watering holes is critical and could be jeopordized by a lowering water table or peizometric head. Such considerations will have to be evaluated on a site-specific basis. It was assumed in this inventory that there would be no near-term changes in the level of livestock grazing. This assumption, however, is questionable because the Bureau of Land Management is currently in the process of completing several grazing environmental impact statements. This process may well result in significant grazing reductions with consequent decline of the ranching industry.

Irrigated agriculture, like grazing, was assumed to remain at its current level. Here again the assumption is questionable because of the final disposition of Carey and DLE Act applications. If lands are released from the public domain a significant expansion could result. This might also impact current grazing activities.

No serious water quality problems were identified during this inventory. Those problems that do exist are primarily associated with the urban areas and were discussed in "Review and Evaluation of Water Supply and Wastewater Facilities for Selected Rural Nevada Communities" (Fordham and Cochran, 1980), a report submitted to Fugro National by DRI.

Urban/Industrial growth was predicated on the "No MX" scenario, wherein growth is related only to expansion of the existing economic base. With limited exception new growth, whether agriculture, mining, energy or urban related, will be based on groundwater development or purchase of existing surface water rights, and those primarily from irrigated agriculture.

INTRODUCTION

This inventory was undertaken to ascertain the extent of existing and seriously planned activities and associated water use within the Nevada MX Siting Area. The inventory was conducted on the basis of hydrographic basins as defined by the Nevada Department of Conservation and Natural Resources. Three basic sectors were defined: 1) Agriculture; 2) Mining and Energy and 3) Urban/Industrial.

This inventory of current levels of activity was based on published information, questionaires and personal contacts. Seriously planned activities were assessed by questionaires and direct contact with entities involved with such expansions. Because of uncertainty in Bureau of Land Management's future grazing allocations and disposition of Carey and DLE Act land applications it is assumed that there will be no near-term changes in agricultural activities.

The inventory is presented in terms of the three major sectors with assumptions and approaches used discussed for each sector. The Appendicies include questionaires utilized and a basin by basin summary of employment, population and water use for the period 1980 - 1995.

Major portions of the overall inventory were sub-contracted by DRI to organizations and individuals well versed in the three major areas. The mining/energy inventory was performed by Geothermal Development Associates, Inc. a Reno firm that has done extensive work in Nevada for many minerals companies and utilities as well as for the Nevada Department of Energy. The Agriculture component was handled by J. Robertson and H. Radke, both former faculty members of the Max C. Fleischman College of Agriculture of University of Nevada-Reno, and specialists respectively in the range of management and agriculture economics. The Urban/Industrial component was prepared by J. Walker and S. Males of the Bureau of Business and Economic Research of University of Nevada-Reno.

AGRICULTURE

The inventory of existing agriculture in the proposed MX Project area is based on available published literature and local information. Agents of the Cooperative Extension Service, Soil Conservation Service, Bureau of Land Management and U.S. Forest Service were contacted in each of the local offices for their assessment of the status of agriculture in the hydrographic areas.

Agriculture is defined to be the production of hay and other crops through irrigation and the management of range lands for grazing purposes. (In this study pinenut production or commercial timber production are not included.)

Irrigation

From the assessment of agricultural production total water consumption by agriculture in each of the hydrographic areas is estimated. All irrigated areas are assumed to have the potential for the production of alfalfa hay. Estimated per acre water consumption by alfalfa hay is then used to derive total water consumption by irrigated agriculture in each of the valleys. Table 2 summarizes irrigated agriculture in each of the Nevada hydrographic basins considered. Distribution of irrigated areas is shown in Plate I.

Grazing

There are several sources of error in estimating grazing use in the MX hydrographic areas.

1. Allotment boundaries do not coincide with the valley boundaries. Stocking rates were apportioned according to approximate land area without knowledge of variation in grazing capacity.
2. Allotments are not fenced so livestock cross other allotments and other valleys.

TABLE 2.

INVENTORY OF AGRICULTURE IN THE PROPOSED MX AREA

Basin Name	Basin No.	Estimated Irrigated Acreage: Estimate made by St. of Nv[1]	Estimated Irrigated Acreage: Estimate made by USGS[2]	Estimated Irrigated Acreage: Estimate made by Personal Contact[3]	Estimated Irrigated Acreage: Used in Analysis	Estimated Consumptive Water Use: Ac-Ft/Ac (4)	Estimated Consumptive Water Use: Ac-Ft/yr.	Agricultural Employment[5]: Irrg. Ag.	Agricultural Employment[5]: Grazing	Agricultural Employment[5]: Total
Big Smoky Valley Tonopah Flat	N-137A	2,070	920	2,070	2,070	2.0	4,140	8.8	11.2	20.0
Big Smoky Valley No. Part	N-137B	10,000	11,260	11,260	11,260	1.8	20,268	47.8	14.7	62.5
Kobeh Valley	N-139	1,800	1,300	1,800	1,800	1.8	3,240	7.6	27.2	34.8
Monitor Valley So. Part	N-140B	2,212	--	2,212	2,212	1.9	4,202	9.4	4.1	13.5
Ralston Valley	N-141	112	50	400	400	1.9	760	1.7	9.6	11.3
Alkali Spring Valley (Esmeralda)	N-142	0	--	--	0	2.4	0	0	2.4	2.4
Clayton Valley	N-143	0	--	80	80	2.4	192	.3	4.1	4.4
Lida Valley	N-144	0	--	80	80	2.3	184	.3	4.2	4.5
Stonewall Flat	N-145	0	--	--	0	1.9	0	0	1.6	1.6
Sarcobatus Flat	N-146	320	--	320	320	1.9	608	1.4	4.4	5.8
Cactus Flat	N-148	0	--	--	0	1.9	0	0	0	0
Stone Cabin Valley	N-149	730	380	750	750	1.9	1,425	3.2	10.0	13.2
Little Fish Lake Vy.	N-150	0	240	240	240	1.9	456	1.0	8.1	9.1
Antelope Valley (Eureka & Nye)	N-151	100	500	500	500	1.9	950	2.1	1.3	3.4
Stevens Basin	N-152	0	--	--	0	1.9	0	0	.5	.5
Diamond Valley	N-153	17,700	20,400	37,000	37,000	1.9	70,300	157.0	21.5	178.2
Newark Valley	N-154	4,600	4,600	4,600	4,600	1.5	6,900	19.5	21.5	41.0
Little Smoky Valley No. Part	N-155A	1,700	800	1,700	1,700	1.9	3,230	7.2	11.5	18.7

TABLE 2. (con't.)

INVENTORY OF AGRICULTURE IN THE PROPOSED MX AREA

Basin Name	Basin No.	Estimated Irrigated Acreage: Estimate made by St. of Nv (1)	Estimated Irrigated Acreage: Estimate made by USGS (2)	Estimated Irrigated Acreage: Estimate made by Personal Contact (3)	Estimated Irrigated Acreage: Used in Analysis	Estimated Consumptive Water Use: Ac-Ft/Ac (4)	Estimated Consumptive Water Use: Ac-Ft/yr.	Agricultural Employment (5): Irrg. Ag.	Agricultural Employment (5): Grazing	Agricultural Employment (5): Total
Little Smoky Valley (Central Part)	N-155B	0	--	--	0	1.9	0	0	.4	.4
Little Smoky Valley (So. Part)	N-155C	0	--	--	0	3.3	0	0	3.03	3.03
Hot Creek	N-156	300	300	300	300	1.9	570	1.3	16.7	18.0
Emigrant Vy Groom Lake Valley	N-158A	0	--	--	0	3.0	0	0	3.3	3.3
Tikapoo Vy (No. Part)	N-169A	0	--	--	0	8.0	0	.0	2.4	2.4
Penoyer Vy (Sand Spring Valley)	N-170	320	--	1,000	1,000	3.0	3,000	4.2	5.9	10.1
Coal Valley	N-171	0	--	--	0	3.0	0	0	4.3	4.3
Garden Valley	N-172	100	--	100	100	2.5	250	.4	8.0	8.4
Railroad Vy (So. Part)	N-173A	0	--	--	0	1.9	0	0	6.5	6.5
Railroad Valley (No. Part)	N-173B	3,500	6,600	6,600	6,600	1.8	11,880	28.0	25.0	53.0
Steptoe Valley	N-179	7,000	9,500	13,000	13,000	1.5	19,500	55.2	32.7	87.9
Cave Valley	N-180	200	400	400	400	2.5	1,000	1.7	2.8	4.5
Dry Lake Valley	N-181	0	--	--	0	3.0	0	0	5.6	5.6
Delamar Valley	N-182	0	--	--	0	3.0	0	0	11.8	11.8
Lake Valley	N-183	3,500	4,600	6,500	6,500	2.8	18,200	27.7	8.2	35.9
Spring Valley	N-184	8,700	9,650	9,650	9,650	1.7	16,405	40.9	55.8	96.7
Pleasant Valley	N-194	300	300	--	300	1.5	450	.9	.3	1.2

TABLE 2. (con't.)

INVENTORY OF AGRICULTURE IN THE PROPOSED MX AREA

Basin Name	Basin No.	Estimated Irrigated Acreage: Estimate made by St. of Nv (1)	Estimated Irrigated Acreage: Estimate made by USGS (2)	Estimated Irrigated Acreage: Estimate made by Personal Contact (3)	Estimated Irrigated Acreage: Used in Analysis	Estimated Consumptive Water Use: Ac-Ft/Ac (4)	Estimated Consumptive Water Use: Ac-Ft/yr.	Agricultural Employment (5): Irrg. Ag.	Agricultural Employment (5): Grazing	Agricultural Employment (5): Total
Snake Valley	N-195	2,500	2,500	2,500	2,500	1.5	3,750	7.8	12.2	20.0
Hamlin Valley	N-196	0	--	50	50	3.0	1,500	.2	4.1	4.3
Dry Valley	N-198	700	700	1,100	1,100	3.0	3,300	.6	3.7	4.3
Rose Valley	N-199	350	350	350	350	3.0	1,050	2.0	.1	2.1
Eagle Valley	N-200	500	500	500	500	3.0	1,500	3.0	.1	3.1
Spring Valley	N-201	1,000	1,100	1,400	1,400	3.0	4,200	8.1	14.7	22.8
Patterson Valley	N-202	0	--	--	0	3.0	0	0	15.2	15.2
Panaca Valley	N-203	2,000	2,300	2,300	2,300	3.0	6,900	13.3	4.1	17.4
Clover Valley	N-204	300	--	--	300	3.0	900	1.7	0	1.7
Lower Meadow Valley	N-205	1,500	1,500	1,500	1,500	3.0	4,500	8.7	10.4	19.1
Kane Springs Valley	N-206	0	--	--	0	3.0	0	0	1.2	1.2
White River Valley	N-207	6,200	6,200	8,000	8,000	2.5	20,000	46.4	29.5	75.9
Pahroc Valley	N-208	0	--	--	0	1.9	0	0	5.4	5.4
Pahranagat Valley	N-209	4,700	5,200	5,200	5,200	3.0	15,600	30.2	4.4	34.6
Total					124,062		248,860	549.6	462.5	1012.1

(1) From "Water for Nevada: Forecasts for the Future--Agriculture", published by State Engineer's Office, Nevada Dept. of Cons. and Nat. Resources, Carson City, 1974.
(2) From the Nevada Water Resources Reconnaissance Series reports as prepared by the U.S. Geological Survey in Cooperation with the Nevada Dept. of Cons. & Nat. Resources. See list of References.
(3) List of individuals contacted is presented following references.
(4) Same as (1); data on page 134.
(5) Based on model presented in "Water for Nevada: Special Report, Input-Output Economic Models" published by State Engineer's Office, Nev. Dept. of Cons. & Nat. Resources, Carson City, 1974. Employment estimates include other sector employment generated by agriculture. Current value of an AUM estimated at $9.60 by Division of Ag Economics, UNR.

3. Wild horses and burros range across all boundaries in unknown numbers and time.

4. The aums from deeded lands are seldom recorded. A flat estimate of 20 acres aum is used.

   The acreages of private rangeland are from records of the county agriculture extension agents and the Soil Conservation Districts. They are estimates from personal knowledge of the White Pine County Soil Conservationist. These so-called brush pastures are mostly fenced in with meadows, pastures or cultivated fields. Neither their areas nor grazing capacities are more than rough estimates.

Bureau of Land Management specifications for range water developments recommend 20 gallons/animal unit day. Accordingly, this report uses 600 gallons as the aum water requirement. Animals rarely drink that much but evaporation and other wasteage make up the difference.

While the guideline called for aum's as of 1979, certain departures appear warranted. An example is seen in the Caliente management area of the Las Vegas district where authorized use, present use and forage capacity are out of accord in several instances. Forage capacity was selected as the most reliable estimate. Also, Stonewall Flat, N-145, was not grazed in 1979 because a fence had not been completed. Otherwise its permit is for 2,800 aums.

Areas 142-146 are blanket estimates without respect to allotments. In addition, 371 allotments were located, each in one or more of the numbered areas.

The equation $\frac{\text{aums}}{543}$ = acre-feet was used to derive aum: water equivalent. Grazing by livestock and wildhorses and burrows in the Nevada hydrographic basins considered are summarized in Table 3.

TABLE 3. INVENTORY OF GRAZING IN THE PROPOSED NEVADA MX AREA

Hydrographic Area	Valley	Animal Unit Month (AUMS) Cattle & Sheep	Horses & Burros	Total	Acre-Foot Equivalent	Number of Allotments
137A	Tonopah Flat	22,451	0	22,415	41.3	5
137B	Big Smoky-North	29,241	120	29,361	54.1	22
139	Kobeh	53,380	1,092	54,472	100.3	16
140B	Monitor, So.	8,097	12	8,109	14.9	11
141	Ralston	18,559	730	19,289	35.5	6
142	Alkali Spring (est)	4,400	480	4,880	9.0	Whole Valley
143	Clayton Vy (est)	6,400	1,860	8,260	15.2	estimates by
144	Lida Vy (est)	8,300	180	8,480	15.6	BLM Area
145	Stonewall Flat (est)	(2,800) not in 1979	312	3,112	5.7	Manager
146	Sarcobatus Flat (est)	8,000	744	8,744	16.1	"
148	Cactus Flat	0	on Bombing	Range	0	2
149	Stone Cabin Vy	17,247	2,808	20,055	36.9	7
150	Little Fish Lake Vy	15,613	600	16,213	29.8	6
151	Antelope (Eureka and Nye)	21,204	4,800	26,004	47.9	5
152	Stevens Basin	910	0	910	1.7	1
153	Diamond Vy	42,059	300	42,439	78.2	11
154	Newark Vy	38,470	5,400	43,870	80.8	12
155A	Little Smoky-No.	17,126	4,800	21,926	40.4	9
155B	Little Smoky-Center	774	0	774	1.4	1
155C	Little Smoky-So.	6,151	0	6,151	11.3	2
156	Hot Creek Vy	31,234	2,274	33,508	61.7	4
158A	Emigrant-Groom	6,390	144	6,534	12.0	2
169A	Tikapoo, No.	4,430	300	4,730	8.7	4
170	Penoyer (Sand Spr.)	10,912	852	11,764	21.7	6
171	Coal Vy	8,112	180	8,292	15.3	8
172	Garden Vy	18,031	540	18,589	34.2	11
173A	Railroad Vy, So.	12,963	0	12,963	23.9	1
173B	Railroad Vy, No.	49,887	3,162	53,049	97.7	21
179	Steptoe Vy	66,659	760	67,419	124.2	40

TABLE 3. (Continued) INVENTORY OF GRAZING IN THE PROPOSED NEVADA MX AREA

Hydrographic Area	Valley	Animal Unit Month (AUMS) Cattle & Sheep	Horses & Burros	Total	Acre-Foot Equivalent	Number of Allotments
180	Cave Vy	5,592	108	5,700	10.5	5
181	Dry Lake Vy	9,127	2,172	11,299	20.8	8
182	Delamar Vy	21,572	3,135	23,707	43.6	4
183	Lake Vy	15,968	510	16,478	30.3	2
184	Spring Vy	107,314	4,228	111,542	205.4	27
194	Pleasant Vy	676	0	676	1.2	1
195	Snake Vy	24,310	50	24,360	44.9	15
196	Hamlin Valley	8,227	0	8,227	15.2	1
198	Dry Valley	5,412	1,932	7,344	13.5	5
199	Rose Valley	165	0	165	0.3	1
200	Eagle Valley	235	0	235	0.4	1
201	Spring Vy-(So.)	26,855	2,550	29,405	54.2	[illegible]
202	Patterson	27,888	2,550	30,438	56.0	[illegible]
203	Panaca	5,883	2,232	8,115	14.9	11
205	Lower Meadow Vy	16,341	4,464	20,805	38.3	22
206	Kane Spring Vy	2,339	0	2,339	4.3	2
207	White River	60,183	3,705	63,888	117.6	43
208	Pahroc	10,341	381	10,722	19.7	7
209	Pahranagat	8,733	0	8,733	16.1	10
Total		873,681	59,487	933,168	1,718.2	371

MINING AND ENERGY

Particular attention and effort were directed to the following ten zones within the MX area: Eureka, Ely, Snake Valley, Railroad Valley, White River Valley, Tonopah, Golfield, Pioche-Caliente, Pahranagat Valley, and Kane Springs Valley.

In all, fifty hydrographic basins in Esmeralda, Eureka, Lander, Lincoln, Nye, and White Pine Counties were included. Of the fifty hydrographic basins within the study area, twenty-six are sites of existing or planned mining and energy activities. The reported water consumption for these activities is summarized in Table 4. Distribution of these activities is shown in Plate II.

TABLE 4. SUMMARY OF MINING AND ENERGY INDUSTRY WATER CONSUMPTION IN PROPOSED MX AREA, NEVADA

User	Existing		Planned		Total Use Ac-ft/yr
	Number	Water Use Ac-ft/yr	Number	Water Use Ac-ft/yr	
Mine/Mill	70[1]	65,153	17[2]	12,593	77,746
Electrical	0	0	2	40,000	40,000
Geothermal	1	0	1	256	256
Total	71	65,153	20	52,849	118,002

[1]Includes Kennecott Precipitation Plant (under construction) at 23.9 ac-ft/day.

[2]Includes 12 expansions and 5 new facilities.

Methodology

A comprehensive list was compiled of:

1. Existing mines, mills, and energy facilities;

2. Mineral property development activities beyond the initial - or intermediate-range exploratory stage; and

3. Energy related projects in the planning stage.

Using the Directory of Nevada Mine Operations Active During Calendar Year 1979 (in press) as a foundation, the list of active mines and mills was expanded through personal interviews with mine and mill operators, electrical and geothermal energy facilities, oil producers, private companies/individuals, utilities, and governmental agencies/individuals.

Each known or possible water-consuming site or facility was contacted by means of a personal interview and/or a mailed questionnaire - usually by both methods. The mailing included:

(1) Cover letter explaining the project data request.

(2) Single page data form to be filled out by each entity (usually partially filled out; see Appendix A).

(3) Additional data form for any planned expansion.

(4) Sample data form filled out on a fictitious mine or mill.

(5) Self-addressed envelope with return postage.

Data Interpretation

An example of an original data form for a mining and energy site is in Appendix A. In many instances, the water consumption recorded is the best estimate of the facility owner or manager, usually given in gallons per minute (gpm).

Mines and Mills

Water consumption for existing and planned facilities are given separately in Table 5 together with State Mine Inspectors Number for extant operation. Site location

Table 5

Existing and Planned Mining/Milling Operations with Associated Water Use and Employment

Basin Name	Basin No.	Operation	Mine I.D. No.	Water Use, gpm Existing	Water Use, gpm Planned	Employment Exg.	Employment Pld.
Big Smoky Vly-Tonopah Flat	N-137A	Nevada Moly Project	1483	12,500	--	400	--
		Manhattan Operation	974	1,000	--	16	--
		Nellie Gray Patent	1136	350	--	2	--
		Manhattan Mill	1544	300	--	5	--
		Manhattan Gulch Placer	1562	2,083	--	3	--
Big Smoky Vly - No. Part	N-137B	Northumberland Mine (Treatment Plant)	N23-7	620	--	60	--
		Round Mtn. Gold Mine & Plant	594	400	--	139	--
		Old Soldier P & S Mine	823	<1	--	4	--
		Bobbie #4 Mine & Mill	1170	N/O	--	2	--
Kobeh Valley	N-139	Elizondo & Wildflower Mines	1551	0	--	3	--
Monitor Vly - So. Part	N-140B	Northumberland Mine	N23-7	50	--	12	--
		Barite Mine & Mill	847	160	1,500	25	--
		Ann Claims	--	--	2,000	--	200
		Water Canyon Mine	--	N/O	--	--	--
Ralston Valley	N-141	Barcelona Mine	597	N/A	--	4	--
Alkali Spring Valley	N-142	Blue Jay Mine	759	<1	--	3	--
		Gemfield Mine	843	N/A	--	2	--
		H.M.C., Inc.	1453	140	--	9	--
		Tonopah Divide Mine	1527	--	1,000	6	16
		International Operation	1528	N/A	--	4	--
Clayton Valley	N-143	Weepah Mine	25	200	--	3	5
		Silverpeak Lithium Mine & Mill	709	8,125	2,000	67	--
		Black Warrior Mine	1568	N/A	--	4	--
Lida Valley	N-144	Nevada Talc Mine	732	0	<1	2	--
		Penny Mine	1337	<1	<1	2	--
Cactus Flat Valley	N-148	Silver Bow Mine	--	--	25	--	--
Stone Cabin Valley	N-149	Golden Arrow Mine	1541	25	25	9	--

Table 5 (con't.)

Existing and Planned Mining/Milling Operations with Associated Water Use and Employment

Basin Name	Basin No.	Operation	Mine I.D. No.	Water Use, gpm Existing	Water Use, gpm Planned	Employment Exg.	Employment Pld.
Diamond Valley	N-153	Windfall Mine	891	75	75	25	35
		Mt. Hope Mill	1132	300	--	12	--
		Diamond Mine	1524	25	25	10	--
		Silver Connor Mine	--	50[b]	--	--	--
Newark Valley	N-154	Bay State Mine	209	25	--	5	--
Little Smoky Vy - No. Part	N-155A	Diamond Silverado Mill	--	25	--	15	--
Hot Creek Valley	N-156	West Reveille Mine	1457	50	50	22	--
		Keystone Mine	1458	25	25	3	--
		Tybo Mine	--	5	--	1	--
		Warm Springs #3	--	N/A	--	2	--
Penoyer Vy (Sand Spring Vy)	N-170	Emerson Mine & Mill	340	5,820	--	196	--
		Frieberg Mines, Inc., Mine	--	50[b]	--	--	--
Railroad Vy - So. Part	N-173A	Gila Canyon Mine	--	50	--	--	--
		South Reveille Mine	--	50[b]	--	--	--
Railroad Vy - No. Part	N-173B	Northridge & A-1 Mine & Mill	1421	N/A	--	1	--
		Currant Creek Project #1745	1540	N/A	--	6	--
		Oneida Mine	1491	N/A	--	3	--
		Commodore Mine	--	0	0	6	--
		Treasure Hill Mine	--	150[c]	--	34	--
Steptoe Valley	N-179	Precipitation Plant (Kennecott)	571	5,390	--	10	--
		Ward Mountain Mine	576	25	--	10	--
		Isbel Pit	813	0	0	2	--
		City of Ely Pit	950	0	0	5	--
		Egan Mill	1401	250	--	10	--
		Taylor Mine	1485	25	50	28	--
		Star Mine	1501	25	--	3	--
		Taylor Mine & Mill	1564	200	--	33	33
		Ely Refinery, Inc.	--	50	--	--	--
		Ely Screening Plant	952	N/A	--	4	--
		J & R Mine	--	N/A	--	3	--
		Teacup Mine	--	N/A	--	--	--

Table 5 (con't.)

Existing and Planned Mining/Milling Operations with Associated Water Use and Employment

Basin Name	Basin No.	Operation	Mine I.D. No.	Water Use, gpm Existing	Water Use, gpm Planned	Employees Exg.	Employees Pln.
Dry Lake Valley	N-181	Silver Horn Mine	1469	N/A	--	9	--
Delamar Valley	N-182	Mackie Perlite Mine	117	0	--	2	--
		Frieberg Mine	1548	N/A	--	11	--
Spring Valley	N-184	Atlanta Mine & Mill	1143	125	125	43	[illegible]
		Silver Park Mine	1557	150	--	5	--
		Golden Era Mines	--	800	--	3	10
Snake Valley	N-195	Bonita Mine	--	300	500	3	--
Patterson Valley	N-202	Pan American Mine	229	N/O	--	--	--
		Pioche Mill	1035	a	--	2	--
		Ely Valley Mill	--	--	200	25	--
Panaca Valley	N-203	Caselton Mill	211	N/O	--	--	--
		Agricultural Minerals Plant	682	100	--	6	--
		Caselton Shaft	1146	N/O	--	--	--
		Sierra Chemical Lime Pit & Kiln	1497	500	--	22	--
		Dorla #1 Mine	1497	1	--	8	--
Clover Valley	N-204	Caliente Perlite Mill	901	0	--	2	--
Pahranagat Valley	N-209	Alamo Services Pit & Mill	--	a	--	2	--

Notes:

- N/A - Not available.
- N/O - Not operating.
- a - Uses city water.
- b - Questionable location.
- c - Only operates May through December.

and Mine Inspector numbers are shown on Plate II. Five mines and mills originally thought to be in operation, were found not to be, and are designated N/O (not operating). Data on an additional thirteen mines and mills could not be obtained for various reasons, and are listed as N/A (not available).

Each facility has been located by section, township and range. Water consumed at each site has been developed at the site, unless stated otherwise. With one exception, all facilities operate throughout the year.

Energy

The White Pine Power Project is a planned 1500 MW electric power generating facility for the Ely region. A specific site has not yet been picked. Five of eight possible sites are in three of the basins within the study area. Of these five, three are in a "most likely" category. For the purposes of this study, the Steptoe Valley/McGill area site is assumed to be the site finally selected.

As part of a long-range electrical power generating plant by Sierra Pacific Power Company, three sites for a 1000 MW plant are being considered within the study area. There is an "extremely low probability" that one of these sites will be selected within the next ten years. The specific basins being considered is proprietary information. This planned facility is shown on Plate II as "Basin Unknown".

The oil producers in the three oil fields in Railroad Valley produce water along with the oil, but all the companies re-inject the water in an aquifer below the oil reservoir. Energy related water use is summarized in Table 6.

TABLE 6. ENERGY RELATED WATER USE

STEPTOE VALLEY N-179, WHITE RIVER VALLEY N-207, or NEWARK VALLEY N-154		
White Pine Power Project 1,500 MW	Planned	20-25,000 acre feet/yr*
MX AREA - Basin Confidential to Sierra Pacific Power Co.		
Fossil Fuel powered electrical power generating station 1,000 MW	Planned	15,000 acre feet/year
CLOVER VALLEY N-204		
Caliente District Space Heating	Planned	17 gpm
Agua Caliente	Existing	150 gpm

*One of five sites shown on Plate II may be the site of this project. There are also three additional sites outside the proposed MX basin area. If one of these additional sites is chosen, the sites in basins N-179, N-207, and N-154 will not be utilized.

URBAN/INDUSTRIAL

At the start of the project, it was decided to define "major" firms as those that employed ten or more full time employees. While this number seemed very small, it was deemed appropriate given the relatively small number of people employed in the impact area.

A mailing list of potential major employers was developed after discussion with the staff of the Employment Security Research Department and pertinent local government/planning officials in each of the urbanized areas. After the list was compiled, the local officials then edited the list to insure that no major firms were missing.

A questionnaire (See Appendix B) was developed to obtain information from these major employers concerning current full time employment, current water consumption and any anticipated changes in the future. The latter was especially important in that it provided the basis for any changes in employment for that area.

The questionnaires were mailed with a cover letter (See Appendix B) from an appropriate local official in hopes of obtaining a higher response rate. After two weeks, telephone calls were placed to those firms that had not yet responded. In all, only a few major firms chose not to cooperate and their employment and water consumption were estimated by comparing responses from comparable firms in the same industry. The questionnaires were then edited to retain only those firms employing ten or more full time employees. Where necessary, incomplete employment and water consumption responses were estimated using comparable firms. The data were then compiled according to hydrographic basin (see Table 7) and used in forecasting future industrial/urban employment and water use.

Water Usage, Employment, and Population

The purpose of this section is to provide estimates of total water usage,

TABLE 7. INVENTORY OF MAJOR URBAN/INDUSTRIAL FIRMS BY HYDROGRAPHIC BASINS WITHIN THE MX IMPACT AREA

BASIN #	FIRM	FULL TIME EMPLOYEES 1980	WATER CONSUMPTION gals./mo. 1980	CHANGES WATER (EMPLOYEES)
179	STEPTOE VALLEY			
	Standard Market	15	302,000	
	Safeway	15	300,000	
	Huskey Service (gas station)	11	204,000	
	H & R Propane	10	2,500	
	Ely Daily Times	10	12,000	
	Hyland Motors	20	150,000	
	Silver State Restaurant	16	100,000	
	Mt. Wheeler Power	36	7,500	
	Harvey W. Young Co. (car dealer)	10	10,000	
	Bank Club	35	80,000	
	Petrelli's Fireside Inn	20	125,000	1981 +31,000 (+5)
	First National Bank	16	2,000	
	William Bee Ririe Hospital	48	570,000	
	Jerry's Restaurant	19	119,000	
	White Pine County Offices	215	150,000	
	Valley Motor Inc.	15	40,000	
	M.B. Bybee Co.	32	230,000	
	Nevada Highway Dept.	46	67,000	
	Ely Motor Supply Co.	11	1,000	
	White Pine Care Center	65	295,000	1985 +100,000 (+20)
	Ely Arctic Circle	16	100,000	
	Eastern Nev. Medical Group	20	186,000	1981 +9,000 (+2)
				1982 +10,000 (+2)
				1985 +10,000 (+1)
				1990 +11,000 (+2)
				1995 +11,000 (+2)
	Nevada National Bank	14	2,000	
	J & R Amoco Services	13	5,000	
	Junction Motor Service	11	5,000	
	Epperson Construction	22	20,000	

TABLE 7. (Continued)

BASIN #	FIRM	FULL TIME EMPLOYEES 1980	WATER CONSUMPTION gals./mo. 1980	CHANGES WATER (EMPLOYEES)
	E - Lee Ford Mercury	14	15,000	1982 +22,000 (+3)
	W & C Contracting Co., Inc.	10	10,000	
	Hotel Nevada	40	465,000	1981 +45,000 (+4)
				1982 +50,000 (+4)
				1983 +50,000 (+7)
				1984 +50,000 (+7)
				1985 +50,000 (+9)
				1990 +50,000 (+15)
				1995 +50,000 (+25)
	White Pine School District	172	297,000	1982 +78,000 (+20)
				1985 +1,134,000 (+271)
				1995 -1,136,000 (-99)
	Bath Lumber Company	15	20,000	1981 +2,000 (+2)
				1982 (+2)
				1983 (+2)
				1984 (+2)
				1985 (+2)
				1990 (+15)
				1995 (+25)
	Nevada Bell	44	9,000	1981 -3,000 (-17)
	BLM	60	43,680	1983 +21,540 (+15)
	Kennecott	350	235,000,000	1982 (+125)
				1990 (-125)
137A	BIG SMOKY VALLEY (TONOPAH FLAT)			
	Nevada Refining Co.	48	480,000	1981 +270,000
				1982 +250,000
	Nevada Telephone-Telegraph Co.	22	6,000	
	Nye County Offices	73	52,000	
	Sierra Pacific Power Co.	10	6,000	
	Coleman's Grocery	12	35,000	
	First National Bank	15	3,000	1981 (+2)
				1984 (+4)
				1995 (+4)

TABLE 7. (Continued)

BASIN #	FIRM	FULL TIME EMPLOYEES 1980	WATER CONSUMPTION gals./mo. 1980	CHANGES WATER (EMPLOYEES)
	Nevada Bell	14	3,000	
	Nye General Hospital	49	300,000	1981 +100,000 (+11)
				1982 +25,000
				1983 +75,000 (+5)
	Mizpah Hotel	100	250,000	
	Nevada Dept. of Highways	36	84,000	
	Tonopah Schools	40	257,000	
202	PATTERSON VALLEY			
	Lincoln County Telephone System	15	3,000	
	Lincoln Co. School District	121	209,000	
	Lincoln Co. Admin. Offices	17	12,000	
153	DIAMOND VALLEY			
	Eureka School District	47	109,000	1981 +10,000 (+2)
				1982 +10,000 (+1)
				1983 +10,000 (+2)
				1984 +10,000 (+2)
				1985 +10,000 (+2)
				1990 +10,000 (+2)
				1995 +10,000 (+2)
	Eureka County Offices	36	474,000	1981 +47,000 (+2)
				1982 +52,000 (+2)
				1983 +57,000 (+2)
				1984 +63,000 (+2)
				1985 +69,000 (+2)
				1990 +76,000 (+2)
				1995 +84,000 (+2)
204	CLOVER VALLEY			
	Gottfredson's Dept. Store	14	35,000	
	Shenanigan's of Caliente	15	12,000	
	Nevada Girls' Training Center	55	1,454,000	1981 +58,000 (+10)
				1982 +58,000
142	ALKALI SPRING VALLEY			
	Esmeralda County Schools	23	17,000	
56	Austin High School	11	70,000	
56	Lander Co. Admin. Offices	11	18,000	

employment, and population by each of the hydrographic basins within the MX Impact area. This information is presented in Appendix C.

The agricultural and mining/energy employment and water usage were obtained as outlined in the previous chapters. The major urban employers who were not using an urban water system were reported as other/urban employers.

Eleven major urban water systems were identified. Water usage estimates were obtained from the DRI report entitled Review and Evaluation of Water Supply and Wastewater Facilities for Selected Rural Nevada Communities and transmitted to Fugro in May 1980. These data are summarized in Table 8.

Population estimates were developed as follows: Total county population estimates for 1979 were obtained from the State Planning Coordinator's Office in Carson City (Table 9). The 1978-1979 population growth rate was used to obtain 1980 county population estimates. Hydrographic basin population estimates were then derived by assuming that the basin population as a proportion of county was the same in 1980 as it was reported in the 1970 census map published by the State Division of Water Planning. This was modified if agricultural employment estimated in the rural basins implied that the population had been underestimated. Also, population associated with mining employment in the nonurban basins was assumed to be located in the nearest urban basin.

Total employment within the rural basins was assumed to be equal to that obtained from the field surveys. Total employment within the urban basins was assumed to be proportional to estimated basin population.

Urban/Industrial employment in the urban areas was then derived by subtracting agricultural, mining/energy, and other urban employment from the total employment. If there was no urban area within the basin, and no major urban employers, it was assumed that there was no industrial/urban employment.

TABLE 8

Water Usage of Urban Systems
in the MX Impact Area

Urban System	Hydrographic Region	Water Usage (ac. ft./yr.)
Austin	56	36
Tonopah	137A	270
Goldfield	142	80
Eureka	153	32
Ely	179	2130
McGill	179	525
Ruth	179	210
Pioche/Caselton	202	94
Panaca	203	210
Caliente	204	555
Alamo	209	198

Source: Review and Evaluation of Water Supply and Wastewater Facilities For Selected Rural Nevada Communities, Desert Research Institute, University of Nevada System, Reno, Nevada.

TABLE 9

POPULATION ESTIMATES BY COUNTY
1970 - 1980, SELECTED YEARS

COUNTY	1970	1978	1979	PERCENT CHANGE 1978-79	1980
Esmeralda	629	835	862	+ 3.2	890
Eureka	948	913	1035	+13.4	1174
Lander	2,666	3478	3666	+ 5.4	3864
Lincoln	2,557	3246	3545	+ 9.2	3871
Nye	5,599	7775	7994	+ 2.8	8218
White Pine	10,150	8700	8889	+ 2.2	9085

SOURCE: State Planning Coordinator's Office, Carson City, NV.

Changes in employment, population and water use were derived using an economic base model. Agriculture, mining/energy, tourism, and manufacturing were assumed to be the basic sectors. Employment and water usage expansions for mining/energy were obtained from the field survey results. The tourist, manufacturing, and agriculture sectors were assumed to remain stable.

Within the urban basins, changes in total base employment were assumed to cause equal changes in industrial/urban employment (the nonbasin or service sector). The economic base changes in rural basins within the community range of urban areas was similarly assumed to affect the urban basin's industrial/urban employment.

Total community area employment growth was assumed to cause urban population growth at the rate of 2.1 persons per job. Industrial/urban water use was then assumed to grow proportionately with urban basin population changes.

An extensive economic base study had just recently been completed for White Pine County (Socioeconomic Analysis of the White Pine Power Project, Bureau of Business and Economic Research, University of Nevada-Reno, 1979). The study's estimates of employment and population expansion were utilized in developing the corresponding data for the Steptoe Valley (Basin N-179), which includes Ely, Ruth and McGill.

It was assumed that the proposed White Pine Power Plant would be located in Steptoe Valley. However, it should be noted that sites are also being considered in other basins (see Mining/Energy).

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AGRICULTURE

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Personal Contacts. Local Cooperative Extension Service Agents, Soil Conservation Service Agents, and local staff of Bureau of Land Management and U.S. Forest Service.

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URBAN/INDUSTRIAL

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3. Population Estimates by County, State Planning Coordinator's Office, Carson City, Nevada.

4. Review and Evaluation of Water Supply and Wastewater Facilities for Selected Rural Nevada Committees, Desert Research Institute, University of Nevada System, Reno, Nevada.

5. Socioeconomic Analysis of the White Pine Power Project, Bureau of Business and Economic Research, University of Nevada, Reno, Reno, Nevada.

6. Water and Related Land Resources with Nevada Population Distribution in 1970, Division of Water Resources, State Engineers Office, Carson City, Nevada.

PERSONAL CONTACTS

I. AGRICULTURE

Name	Agency	Phone Number
Tony Howard	U.S. Forest Service, Austin	964-2671
Henry Walters	U.S. Forest Service, Ely	289-3031
Joe Marion	Coop. Ext. Service, Eureka	237-5326
Ed Peterson	Soil Conservation Service, Eureka	237-5251
Neil Talbot, Joe De Champ, Kelly Madigan	Bureau of Land Management, Battle Mountain	635-5181
Bill Cunningham	Soil Conserv. Serv., Battle Mountain	635-2650
Harlan Arnold	Soil Conservation Service, Ely	289-4065
Ed Nathan	Soil Conservation Service, Reno	784-5304
Jim Harold	U.S. Geological Survey, Carson City	882-1388
Kris Mayer	Bureau of Land Management, Tonopah	482-6214
Stephen Rynas	Bureau of Land Management, Ely	289-4065
Robert Walstrom	Nevada Div. of Water Planning	885-4877
A.Z. Joy	Coop. Ext. Service, Ely	289-4459
Darwin Bradfield	Coop. Ext. Service, Caliente	726-3101
Lenard Smith	Soil Conservation Serv., Caliente	726-3101
Stan Van Velsor	Bur. of Land Management, Caliente	726-3141
Stu Kyle	Soil Conservation Service, Tonopah	482-3942
Vern Sylvester	U.S. Forest Service, Reno	784-5331
Bill Civich	Bur. of Land Management, Las Vegas	385-6403
John Jamrod	Bur. of Land Management, Las Vegas	385-6627
Rich Howard	Bur. of Land Management, Ely	289-4065
Dr. R.O. Gifford	PSW-Soils, UNR	784-6947
Tom Combs	Bur. of Land Management, Las Vegas	385-6403

II. MINING AND ENERGY

Oil Producers

Eagle Springs

Toiyabe Oil, Inc.

Western Oil Lands, Inc.

Ely Crude Oil*

Trap Spring

Chadco, Inc.

Northwest Exploration, Inc.

Texaco, Inc.

Currant Field

Northwest Exploration, Inc.

All producers contacted stated that they were producing water from the 5000' to 7000' depth and were reinjecting it at a depth slightly below the production depth.

*Due to inability to locate this company, it was not contacted, but it is assumed that they are producing and reinjecting water as the other companies are doing.

Private Companies and Individuals

Bill Clem - Miner's & Prospector's Association
Western Testing Laboratories

Bob Warren - Executive Secretary, Nevada Mining Association

Warren Woodward - Consulting geologist

Bethex Corporation
Kevin Buchanan - chief geologist

Amselco
Jeff McCloud - Smith

Isenman Chemical Co.
Nancy Isenman

Imco Services
Mr. Beaman
National Geothermal Corp.
Hugh McLaughlin

Utilities

Sierra Pacific Power Co.
Dick Richards - Engineer

Nevada Power Co.
Mr. Anderson - Customer Technical Service
Mr. Joe Fujimoto - production
Mr. Dave Barnaby - project manager for Reed-Gardner
Mr. John Arledge

Mt. Wheeler Power Co.
Bill Kaufman

White Pine Power Project
Mike Bourn - Executive Director

Governmental Agencies

State of Nevada

Dick Jones - economic geologist
Joe Tingley - economic geologist
Bill Dubois - Mine Inspector
Kent Rollins - Assistant Mine Inspector
Southeastern Nevada
Larry Blaylock - Deputy Mine Inspector
Northeastern Nevada
Joyce Hall - Administrator
Division of Mineral Resources
Jim Hawk - State water planner
Division of Water Resources
Bill Newman - State Engineer
Division of Water Resources
Jack Cardinalli - Engineer
Division of Water Resources
Harry Val Dreilen - Department of Environmental Protection
Kelly Jackson - Deputy Director
Nevada Department of Energy
Maggie Pugsley - Urban planner
Nevada Department of Energy

Federal

Jim Fraser - MSHA (Mining Safety and Health Administration)
OSHA (Occupational Safety and Health Administration)
Ed Tilson - Planning
Bureau of Land Management
Larry Stewart - Mineral specialist
Bureau of Land Management
Terry Randolph - Forest planner - Supervisor's Office - Carson City
U.S. Forest Service
Glade Quilter - Tonopah District Ranger
U.S. Forest Service
Jack Wilcox - Ely District Ranger
U.S. Forest Service

III. URBAN/INDUSTRIAL

1. Dr. Robert Barone - Research Faculty, Bureau of Business and Economic Research, University of Nevada, Reno, Reno, Nevada.
2. Mr. Michael Bourn - Director, White Pine County Development Corporation, Carson City, Nevada.
3. Mr. Dan Culbert - Research Analyst, Employment Security Research Department, Carson City, Nevada.
4. Dr. Gano Evans - Research Faculty, Bureau of Business and Economic Research, University of Nevada, Reno, Reno, Nevada.
5. Mr. Mike Fogliani - Chairman, Three County MX Oversight Committee, Pioche, Nevada.
6. Mr. David Hamilton - Nye County Planning Director, Tonopah, Nevada.
7. Mr. Jim Hanna - Chief, Employment Security Research Department, Carson City, Nevada.
8. Mr. Ralph Orgill - Controller, Kennecott Copper Company, McGill, Nevada.
9. Mr. Robert Rigsby - Senior Planner, State Planning Coordinator's Office, Carson City, Nevada.
10. Ms. Betty Whitehurst - Manager, White Pine Chamber of Commerce, Ely, Nevada.
11. Mr. Ray Williams - Director, Lander County Sewer and Water District #2, Austin, Nevada.

APPENDIX A

EXAMPLE MINING/MILLING/ENERGY QUESTIONNAIRE RESPONSES

BASIN NAME: Big Smoky Valley - Tonopah Flat

BASIN NO: N-137A FILE NO: 16-06-00-03

MINE I.D. NO: 1562

OPERATION NAME: Manhattan Gulch Placer

OPERATION LOCATION: Sec. 19; T. 8 N., R. 44 E.

OPERATOR NAME: Gibbons & Reed Co.

MAILING ADDRESS: P.O. Box 17465, Salt Lake City, UT 84117

TELEPHONE NO:

SUPERINTENDENT: Jim Lindsay, Manager

DATA SOURCE:

NO. OF WORKERS: 3 TYPE OF OPERATION OP

COMMODITY: Gold

AMOUNT OF WATER USED: 3,000,000 gal./day

TYPE OF BENEFICIAL USE: Placer Gold dredging

WATER SOURCE: Wells

WATER RECIRCULATED: 80%, hopefully

WATER QUALITY:
POTABLE: ____ STOCK ____ AGRICULTURE ____ OTHER ?

OPERATION - REOPENED: Reopened NEW:

WATER PRODUCTION: Wells and ponds

PLANNED EXPANSION: Yes. may require more water

REMARKS: The maps I have seen of the MX do not show it using Big Smokey Valley. I would like to know how much water the MX is going to need? and how they plan to acquire it?

BASIN NAME: ______

BASIN NO: ______ FILE NO: ______

MINE I.D. NO: ______

OPERATION NAME: Fossil fuel powered electrical power generating station

OPERATION LOCATION: Confidential - but three of the possible locations are in the proposed MX area

OPERATOR NAME: Sierra Pacific Power Co.

MAILING ADDRESS: 100 E. Moana Lane, Reno, Nevada 89502

TELEPHONE NO: 702-789-4321

SUPERINTENDENT: ______

DATA SOURCE: Dick Richards, engineer

NO. OF WORKERS: ______ TYPE OF OPERATION ______

COMMODITY: 1,000 MW

AMOUNT OF WATER USED: 15,000 acre-feet/year

TYPE OF BENEFICIAL USE: ______

WATER SOURCE: ______

WATER RECIRCULATED: ______

WATER QUALITY:
POTABLE: ____ STOCK ____ AGRICULTURE ____ OTHER ______

OPERATION - REOPENED: ______ NEW: ______

WATER PRODUCTION: ______

PLANNED EXPANSION: ______

REMARKS: ______

APPENDIX B

MAJOR EMPLOYER QUESTIONNAIRE

UNIVERSITY OF NEVADA · RENO

RENO, NEVADA 89557 • (702) 784-6877

Bureau of Business and Economic Research
College of Business Administration

March 24, 1980

Dear Manager/Administrator:

The Bureau of Business and Economic Research has been asked to identify major industrial activity in the proposed MX missile region and other surrounding areas which may be impacted by this project.

After discussions with local political/business leaders in your community, your business/organization has been classified as a major component of the local economy. As such, we need to identify how many people you employ and your present and future water needs. The data is needed to insure water requirements will be included in any future planning for the area.

Please fill out the enclosed questionnaire and return it in the self-addressed stamped envelope by ______________. If you have any questions in completing the questionnaire, please contact the Bureau (James Walker or Sam Males) at 784-6877 (call collect). Also, you may contact Dave Hamilton, Nye County Planning Director at 482-3581.

We can not emphasize strongly enough how important your participation in this survey is. Accurate information is essential to insure that all water needs will be properly considered in the planning for the possible MX project.

Thank you for your cooperation.

Sincerely,

James L. Walker
Director

JLW/nt

enclosure

WATER USAGE SURVEY

Name of Firm: ______________________________

Address: ______________________________

____

Current Number of Full-time employees: __________

Source of Water:

Local city water system? yes ______ no ______

Own well: yes ______ no ______

If other, please specify: ______________________________

____

Estimated current water usage:

Average monthly water usage: ______________________________

If unknown, what about average annual usage or some other measure (size of water main or pumping system)?

____

____

In the absence of the proposed MX Project, do you have any definite plans for changes in your water needs and employment over the 1980-1995 period? yes ______ no ______

If yes, please complete the following table:

	Change In Water Consumption	Change In # Of Employees
1981		
1982		
1983		
1984		
1985		
1990		
1995		

If there are any questions, who may we contact?

______________________________ phone # ______________________________

THANK YOU!

APPENDIX C

POPULATION, EMPLOYMENT AND WATER USE BY HYDROGRAPHIC BASIN: 1980-1995

BASIN #: 137A

BASIN NAME: Big Smoky Valley - Tonopah Flat

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	20	→	→	→	→	→	→	20
Water Usage (ac. ft./yr.)	4,140	→	→	→	→	→	→	4,140
MINING/ENERGY								
Employment	436	→	→	→	→	→	→	436
Water Usage (ac. ft./yr.)	26,172	→	→	→	→	→	→	26,172
INDUSTRIAL/URBAN								
Employment	1,694	1,894	2,103	2,158	→	→	→	2,158
Water Usage (ac. ft./yr.)	270	344	429	450	→	→	→	450
TOTAL								
Employment	2,150	2,350	2,559	2,614	→	→	→	2,614
Water Usage	30,582	30,656	30,741	30,762	→	→	→	30,762
Population	3,048	3,888	4,766	4,997	→	→	→	4,997

BASIN #: 137B

BASIN NAME: Big Smoky Valley - Northern Part (within commuting range of Austin)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	63	→	→	→	→	→	→	63
Water Usage (ac. ft./yr.)	20,268	→	→	→	→	→	→	20,268
MINING/ENERGY								
Employment	203	→	→	→	→	→	→	203
Water Usage (ac. ft./yr.)	1,643	→	→	→	→	→	→	1,643
TOTAL								
Employment	266	→	→	→	→	→	→	266
Water Usage	21,911	→	→	→	→	→	→	21,911
Population	251	→	→	→	→	→	→	251

BASIN #: 139

BASIN NAME: Kobeh Valley
(within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	35	→	→	→	→	→	→	35
Water Usage (ac. ft./yr.)	3,240	→	→	→	→	→	→	3,240
MINING/ENERGY								
Employment	3	→	→	→	→	→	→	3
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	38	→	→	→	→	→	→	38
Water Usage	3,240	→	→	→	→	→	→	3,240
Population	9	→	→	→	→	→	→	9

BASIN #: 140B

BASIN NAME: Monitor Valley - Southern Part (within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	14	→	→	→	→	→	→	14
Water Usage (ac. ft./yr.)	4,204	→	→	→	→	→	→	4,204
MINING/ENERGY								
Employment	37	237	237	446	→	→	→	446
Water Usage (ac. ft./yr.)	338	3,220	3,220	5,635	→	→	→	5,635
TOTAL								
Employment	51	251	251	460	→	→	→	460
Water Usage	4,542	7,424	7,424	9,839	→	→	→	9,839
Population	13	13	13	13	→	→	→	13

BASIN #: 141

BASIN NAME: Ralston Valley
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	11	→	→	→	→	→	→	11
Water Usage (ac. ft./yr.)	760	→	→	→	→	→	→	760
MINING/ENERGY								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	15	→	→	→	→	→	→	15
Water Usage	760	→	→	→	→	→	→	760
Population	34	→	→	→	→	→	→	34

BASIN #: 142

BASIN NAME: Alkali Spring Valley (Esmeralda)
(includes town of Goldfield)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	2	→	→	→	→	→	→	2
Water Usage (ac. ft./yr.)	0							0
MINING/ENERGY								
Employment	12	→	→	18	→	→	→	18
Water Usage (ac. ft./yr.)	227	→	→	1,837	→	→	→	1,837
INDUSTRIAL/URBAN								
Employment	72	74	74	80	→	→	→	80
Water Usage (ac. ft./yr.)	80	82	82	88	→	→	→	88
TOTAL								
Employment	86	88	88	100	→	→	→	100
Water Usage	307	309	309	1,925	→	→	→	1,925
Population	340	348	348	373	→	→	→	373

BASIN #: 143

BASIN NAME: Clayton Valley
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	192	→	→	→	→	→	→	192
MINING/ENERGY								
Employment	67	→	→	86	→	→	→	86
Water Usage (ac. ft./yr.)	13,081	→	→	16,623	→	→	→	16,623
TOTAL								
Employment	71	→	→	90	→	→	→	90
Water Usage	13,273	→	→	16,815	→	→	→	16,815
Population	214	→	→	214	→	→	→	214

BASIN #: 144

BASIN NAME: Lida Valley
(within commuting range of Goldfield)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	5	→	→	→	→	→	→	5
Water Usage (ac. ft./yr.)	184	→	→	→	→	→	→	184
MINING/ENERGY								
Employment	6	8	→	→	→	→	→	8
Water Usage (ac. ft./yr.)	3	5	→	→	→	→	→	5
TOTAL								
Employment	11	13	→	→	→	→	→	13
Water Usage	187	189	→	→	→	→	→	189
Population	26	26	→	→	→	→	→	26

BASIN #: 145

BASIN NAME: Stonewall Flat
(within commuting range of Goldfield)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	2	→	→	→	→	→	→	2
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	2	→	→	→	→	→	→	2
Water Usage	0	→	→	→	→	→	→	0
Population	0	→	→	→	→	→	→	0

BASIN #: 146

BASIN NAME: Sarcobatus Flat
(within commuting range of Goldfield & Beatty)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	6	→	→	→	→	→	→	6
Water Usage (ac. ft./yr.)	608	→	→	→	→	→	→	608
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	6	→	→	→	→	→	→	6
Water Usage	608	→	→	→	→	→	→	608
Population	27	→	→	→	→	→	→	27

BASIN #: 148

BASIN NAME: Cactus Flat
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	2	→	→	→	2
Water Usage (ac. ft./yr.)	0	→	→	40	→	→	→	40
TOTAL								
Employment	0	→	→	2	→	→	→	2
Water Usage	0	→	→	40	→	→	→	40
Population	0	→	→	0	→	→	→	0

BASIN #: 149

BASIN NAME: Stone Cabin Valley
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	13	→	→	→	→	→	→	13
Water Usage (ac. ft./yr.)	1,425	→	→	→	→	→	→	1,425
MINING/ENERGY								
Employment	9	→	→	18	→	→	→	18
Water Usage (ac. ft./yr.)	40	→	→	80	→	→	→	80
TOTAL								
Employment	22	→	→	31	→	→	→	31
Water Usage	1,465	→	→	1,505	→	→	→	1,505
Population	27	→	→	27	→	→	→	27

BASIN #: 150

BASIN NAME: Little Fish Lake Valley (within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	9	→	→	→	→	→	→	9
Water Usage (ac. ft./yr.)	456	→	→	→	→	→	→	456
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	9	→	→	→	→	→	→	9
Water Usage	456	→	→	→	→	→	→	456
Population	18	→	→	→	→	→	→	18

BASIN #: 151

BASIN NAME: Antelope Valley (Eureka & Nye)
(within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	3	→	→	→	→	→	→	3
Water Usage (ac. ft./yr.)	950	→	→	→	→	→	→	950
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	3	→	→	→	→	→	→	3
Water Usage	950	→	→	→	→	→	→	950
Population	16	→	→	→	→	→	→	16

BASIN #: 152

BASIN NAME: Stevens Basin
(within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	1	→	→	→	→	→	→	1
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	1	→	→	→	→	→	→	1
Water Usage	0	→	→	→	→	→	→	0
Population	0	→	→	→	→	→	→	0

BASIN #: 153

BASIN NAME: Diamond Valley (includes City of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	178	→	→	→	→	→	→	178
Water Usage (ac. ft./yr.)	70,300	→	→	→	→	→	→	70,300
MINING/ENERGY								
Employment	94	→	→	104	→	→	→	104
Water Usage (ac. ft./yr.)	845	→	→	885	→	→	→	885
INDUSTRIAL/URBAN								
Employment	151	151	151	161	→	→	→	161
Water Usage (ac. ft./yr.)	32	32	32	33	→	→	→	33
TOTAL								
Employment	423	423	423	443	→	→	→	443
Water Usage	71,177	71,177	71,177	71,218	→	→	→	71,218
Population	626	626	626	668	→	→	→	668

BASIN #: 154

BASIN NAME: Newark Valley
(within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	41	→	→	→	→	→	→	41
Water Usage (ac. ft./yr.)	6,900	→	→	→	→	→	→	6,900
MINING/ENERGY								
Employment	5	→	→	→	→	→	→	5
Water Usage (ac. ft./yr.)	40	→	→	→	→	→	→	40
TOTAL								
Employment	46	→	→	→	→	→	→	46
Water Usage	6,940	→	→	→	→	→	→	6,940
Population	16	→	→	→	→	→	→	16

BASIN #: 155A

BASIN NAME: Little Smoky Valley - Northern Part (within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	19	→	→	→	→	→	→	19
Water Usage (ac. ft./yr.)	3,230	→	→	→	→	→	→	3,230
MINING/ENERGY								
Employment	15	→	→	→	→	→	→	15
Water Usage (ac. ft./yr.)	40	→	→	→	→	→	→	40
TOTAL								
Employment	34	→	→	→	→	→	→	34
Water Usage	3,270	→	→	→	→	→	→	3,270
Population	17	→	→	→	→	→	→	17

BASIN #: 155B

BASIN NAME: Little Smoky Valley - Central Part

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	0	→	→	→	→	→	→	0
Water Usage	0	→	→	→	→	→	→	0
Population	0	→	→	→	→	→	→	0

BASIN #: 155C

BASIN NAME: Little Smoky Valley - Southern Part (within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	3	→	→	→	→	→	→	3
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	3	→	→	→	→	→	→	3
Water Usage	0	→	→	→	→	→	→	0
Population	6	→	→	→	→	→	→	6

BASIN #: 156

BASIN NAME: Hot Creek
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	18	→	→	→	→	→	→	18
Water Usage (ac. ft./yr.)	570	→	→	→	→	→	→	570
MINING/ENERGY								
Employment	26	→	→	51	→	→	→	51
Water Usage (ac. ft./yr.)	129	→	→	250	→	→	→	250
TOTAL								
Employment	44	→	→	69	→	→	→	69
Water Usage	699	→	→	820	→	→	→	820
Population	40	→	→	40	→	→	→	40

BASIN #: 169A

BASIN NAME: Tikapoo Valley - Northern Part
(within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	2	→	→	→	→	→	→	2
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	2	→	→	→	→	→	→	2
Water Usage	0	→	→	→	→	→	→	0
Population	4	→	→	→	→	→	→	4

BASIN #: 170

BASIN NAME: Penoyer Valley (Sand Spring Valley)
(within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	10	→	→	→	→	→	→	10
Water Usage (ac. ft./yr.)	3,000	→	→	→	→	→	→	3,000
MINING/ENERGY								
Employment	198	→	→	→	→	→	→	198
Water Usage (ac. ft./yr.)	9,451	→	→	→	→	→	→	9,451
TOTAL								
Employment	208	→	→	→	→	→	→	208
Water Usage	12,451	→	→	→	→	→	→	12,451
Population	21	→	→	→	→	→	→	21

BASIN #: 171

BASIN NAME: Coal Valley
(within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	4	→	→	→	→	→	→	4
Water Usage	0	→	→	→	→	→	→	0
Population	8	→	→	→	→	→	→	8

BASIN #: 172

BASIN NAME: Garden Valley
(distant commute to Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	8	→	→	→	→	→	→	8
Water Usage (ac. ft./yr.)	250	→	→	→	→	→	→	250
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	8	→	→	→	→	→	→	8
Water Usage	250	→	→	→	→	→	→	250
Population	17	→	→	→	→	→	→	17

BASIN #: 173A

BASIN NAME: Railroad Valley - Southern Part
(within commuting range of Tonopah)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	7	→	→	→	→	→	→	7
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	161	→	→	→	→	→	→	161
TOTAL								
Employment	11	→	→	→	→	→	→	11
Water Usage	161	→	→	→	→	→	→	161
Population	14	→	→	→	→	→	→	14

BASIN #: 173B

BASIN NAME: Railroad Valley - Northern Part (within commuting range of Eureka)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	53	→	→	→	→	→	→	53
Water Usage (ac. ft./yr.)	11,880	→	→	→	→	→	→	11,880
MINING/ENERGY								
Employment	40	→	→	→	→	→	→	40
Water Usage (ac. ft./yr.)	242	→	→	→	→	→	→	242
TOTAL								
Employment	93	→	→	→	→	→	→	93
Water Usage	12,122	→	→	→	→	→	→	12,122
Population	264	→	→	→	→	→	→	264

BASIN #: 179

BASIN NAME: Steptoe Valley
(includes Ely, McGill & Ruth)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	88	→	→	→	→	→	→	88
Water Usage (ac. ft./yr.)	19,500	→	→	→	→	→	→	19,500
MINING/ENERGY								
Employment	451	451	576	632	717	2,400	917	917
Water Usage (ac. ft./yr.)	9,604	9,604	9,604	9,654	9,654	34,694*	34,694	34,694
INDUSTRIAL/URBAN								
Employment	1,976	1,899	1,749	1,652	1,697	2,450	2,168	2,239
Water Usage (ac. ft./yr.)	2,865	2,808	2,780	2,758	2,818	4,423	3,483	3,452
OTHER URBAN (own well)								
Employment	90	95	95	110	→	→	→	110
Water Usage (ac. ft./yr.)	7	7	7	8	→	→	→	8
TOTAL								
Employment	2,605	2,533	2,508	2,482	2,612	5,048	3,283	3,354
Water Usage	31,976	31,919	31,891	31,920	31,980	58,625	57,685	57,654
Population	8,536	8,369	8,285	8,220	8,399	13,180	10,379	10,288

* Water for power plant expected to be on line between 1985-1990.

BASIN #: 180

BASIN NAME: Cave Valley
(within commuting range of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	5	→	→	→	→	→	→	5
Water Usage (ac. ft./yr.)	1,000	→	→	→	→	→	→	1,000
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	5	→	→	→	→	→	→	5
Water Usage	1,000	→	→	→	→	→	→	1,000
Population	11	→	→	→	→	→	→	11

BASIN #: 181

BASIN NAME: Dry Lake Valley
(within commuting range of Caliente)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	6	→	→	→	→	→	→	6
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	6	→	→	→	→	→	→	6
Water Usage	0	→	→	→	→	→	→	0
Population	13	→	→	→	→	→	→	13

BASIN #: 182

BASIN NAME: Delamar Valley
(within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	12	→	→	→	→	→	→	12
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	13	→	→	→	→	→	→	13
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	25	→	→	→	→	→	→	25
Water Usage	0	→	→	→	→	→	→	0
Population	25	→	→	→	→	→	→	25

BASIN #: 183

BASIN NAME: Lake Valley
(within commuting range of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	36	→	→	→	→	→	→	36
Water Usage (ac. ft./yr.)	18,200	→	→	→	→	→	→	18,200
MINING/ENERGY								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	40	→	→	→	→	→	→	40
Water Usage	18,200	→	→	→	→	→	→	18,200
Population	73	→	→	→	→	→	→	73

BASIN #: 184

BASIN NAME: Spring Valley
(within commuting range of Ely)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	97	→	→	→	→	→	→	97
Water Usage (ac. ft./yr.)	16,405	→	→	→	→	→	→	16,405
MINING/ENERGY								
Employment	51	→	→	94	→	→	→	94
Water Usage (ac. ft./yr.)	1,731	→	→	1,932	→	→	→	1,932
TOTAL								
Employment	148	→	→	191	→	→	→	191
Water Usage	18,136	→	→	18,337	→	→	→	18,337
Population	204	→	→	204	→	→	→	204

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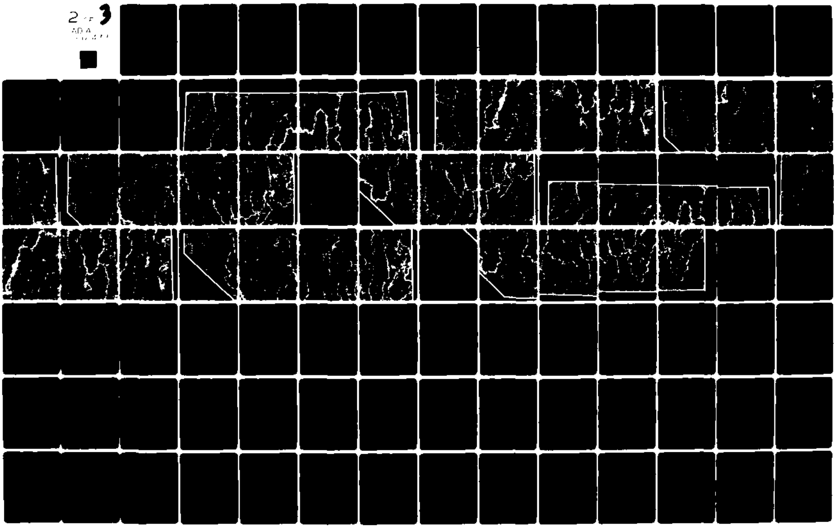

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BASIN #: 194

BASIN NAME: Pleasant Valley
(within commuting range of Baker)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	1	→	→	→	→	→	→	1
Water Usage (ac. ft./yr.)	450	→	→	→	→	→	→	450
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	1	→	→	→	→	→	→	1
Water Usage	450	→	→	→	→	→	→	450
Population	4	→	→	→	→	→	→	4

BASIN #: 195

BASIN NAME: Snake Valley
(within commuting range of Ely)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	20	→	→	→	→	→	→	20
Water Usage (ac. ft./yr.)	3,750	→	→	→	→	→	→	3,750
MINING/ENERGY								
Employment	3	→	→	8	→	→	→	8
Water Usage (ac. ft./yr.)	483	→	→	1,288	→	→	→	1,288
TOTAL								
Employment	23	→	→	28	→	→	→	28
Water Usage	4,223	→	→	5,038	→	→	→	5,038
Population	113	→	→	113	→	→	→	113

BASIN #: 196

BASIN NAME: Hamlin Valley
(within commuting range of Ely)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	1,500	→	→	→	→	→	→	1,500
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	4	→	→	→	→	→	→	4
Water Usa;	1,500	→	→	→	→	→	→	1,500
Population	8	→	→	→	→	→	→	8

BASIN #: 198

BASIN NAME: Dry Valley
(within commuting range of Panaca)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	4	→	→	→	→	→	→	4
Water Usage (ac. ft./yr.)	3,300	→	→	→	→	→	→	3,300
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	4	→	→	→	→	→	→	4
Water Usage	3,300	→	→	→	→	→	→	3,300
Population	8	→	→	→	→	→	→	8

BASIN #: 199

BASIN NAME: Rose Valley
(within commuting range of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	2	→	→	→	→	→	→	2
Water Usage (ac. ft./yr.)	1,050	→	→	→	→	→	→	1,050
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	2	→	→	→	→	→	→	2
Water Usage	1,050	→	→	→	→	→	→	1,050
Population	4	→	→	→	→	→	→	4

BASIN #: 200

BASIN NAME: Eagle Valley
(within commuting range of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	3	→	→	→	→	→	→	3
Water Usage (ac. ft./yr.)	1,500	→	→	→	→	→	→	1,500
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	3	→	→	→	→	→	→	3
Water Usage	1,500	→	→	→	→	→	→	1,500
Population	93	→	→	→	→	→	→	93

BASIN #: 201

BASIN NAME: Spring Valley
(within commuting range of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	23	→	→	→	→	→	→	23
Water Usage (ac. ft./yr.)	4,200	→	→	→	→	→	→	4,200
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	23	→	→	→	→	→	→	23
Water Usage	4,200	→	→	→	→	→	→	4,200
Population	48	→	→	→	→	→	→	48

BASIN #: 202

BASIN NAME: Patterson Valley
(includes Town of Pioche)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	15	→	→	→	→	→	→	15
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	27	→	→	→	→	→	→	27
Water Usage (ac. ft./yr.)	322	→	→	→	→	→	→	322
INDUSTRIAL/URBAN								
Employment	206	→	→	→	→	→	→	206
Water Usage (ac. ft./yr.)	94	→	→	→	→	→	→	94
TOTAL								
Employment	248	→	→	→	→	→	→	248
Water Usage	416	→	→	→	→	→	→	416
Population	807	→	→	→	→	→	→	807

BASIN #: 203

BASIN NAME: Panaca Valley
(includes Town of Panaca)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	17	→	→	→	→	→	→	17
Water Usage (ac. ft./yr.)	6,900	→	→	→	→	→	→	6,900
MINING/ENERGY								
Employment	36	→	→	→	→	→	→	36
Water Usage (ac. ft./yr.)	968	→	→	→	→	→	→	968
INDUSTRIAL/URBAN								
Employment	195	→	→	→	→	→	→	195
Water Usage (ac. ft./yr.)	210	→	→	→	→	→	→	210
TOTAL								
Employment	248	→	→	→	→	→	→	248
Water Usage	8,078	→	→	→	→	→	→	8,078
Population	813	→	→	→	→	→	→	813

BASIN #: 204

BASIN NAME: Clover Valley
(includes City of Caliente)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	12	→	→	→	→	→	→	12
Water Usage (ac. ft./yr.)	269	→	→	→	→	→	→	269
INDUSTRIAL/URBAN								
Employment	417	427	447	→	→	→	→	447
Water Usage (ac. ft./yr.)	555	557	573	→	→	→	→	573
OTHER URBAN (own well)								
Employment	0	0	0	→	→	→	→	0
Water Usage (irrigation)	30	30	30	→	→	→	→	30
TOTAL								
Employment	429	439	459	→	→	→	→	459
Water Usage	854	856	872	→	→	→	→	872
Population	1,406	1,427	1,469	→	→	→	→	1,469

BASIN #: 205

BASIN NAME: Lower Meadow Valley Wash
(within commuting range of Caliente)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	19	→	→	→	→	→	→	19
Water Usage (ac. ft./yr.)	4,500	→	→	→	→	→	→	4,500
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	19	→	→	→	→	→	→	19
Water Usage	4,500	→	→	→	→	→	→	4,500
Population	58	→	→	→	→	→	→	58

BASIN #: 206

BASIN NAME: Kane Springs Valley
(within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	1	→	→	→	→	→	→	1
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	1	→	→	→	→	→	→	1
Water Usage	0	→	→	→	→	→	→	0
Population	2	→	→	→	→	→	→	2

BASIN #: 207

BASIN NAME: White River Valley (includes towns of Lund, Preston, within commuting range of Ely)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	76	→	→	→	→	→	→	76
Water Usage (ac. ft./yr.)	20,000	→	→	→	→	→	→	20,000
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	76	→	→	→	→	→	→	76
Water Usage	20,000	→	→	→	→	→	→	20,000
Population	290	→	→	→	→	→	→	290

BASIN #: 208

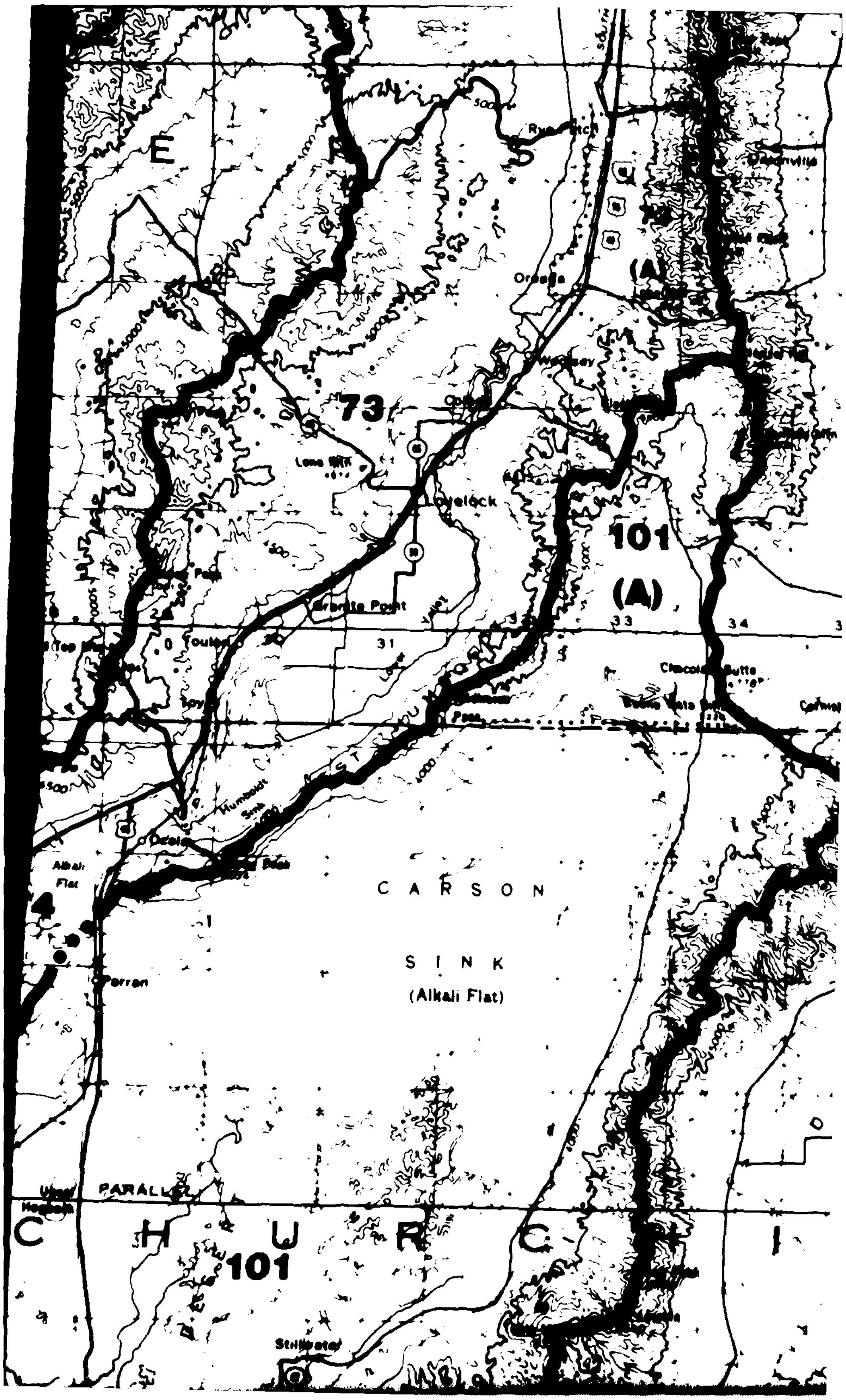
BASIN NAME: Pahroc Valley (within commuting range of Alamo)

	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	5	→	→	→	→	→	→	5
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
MINING/ENERGY								
Employment	0	→	→	→	→	→	→	0
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
TOTAL								
Employment	5	→	→	→	→	→	→	5
Water Usage	0	→	→	→	→	→	→	0
Population	11	→	→	→	→	→	→	11

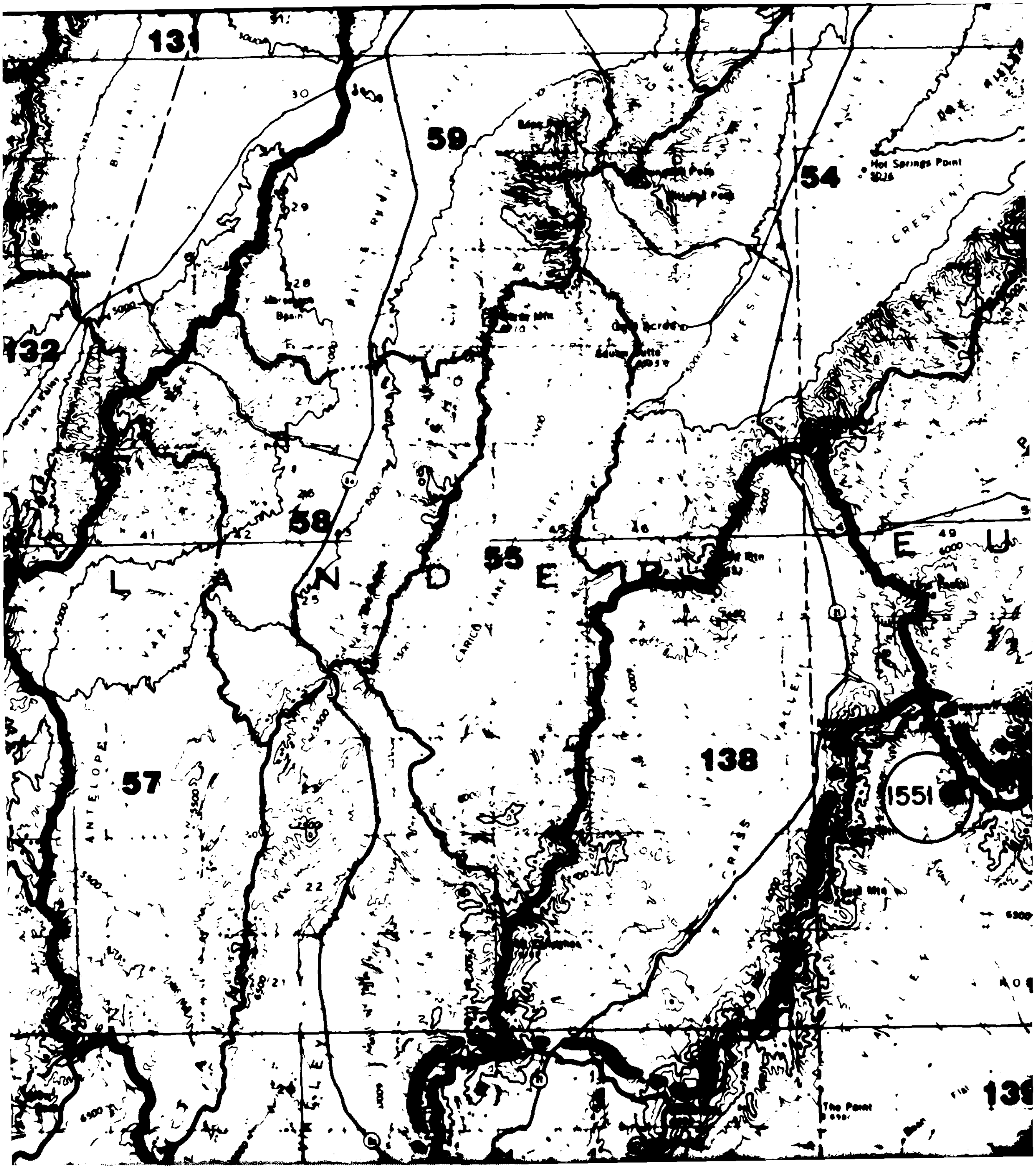
BASIN #: 209

BASIN NAME: Pahranagat Valley
(includes Town of Alamo)

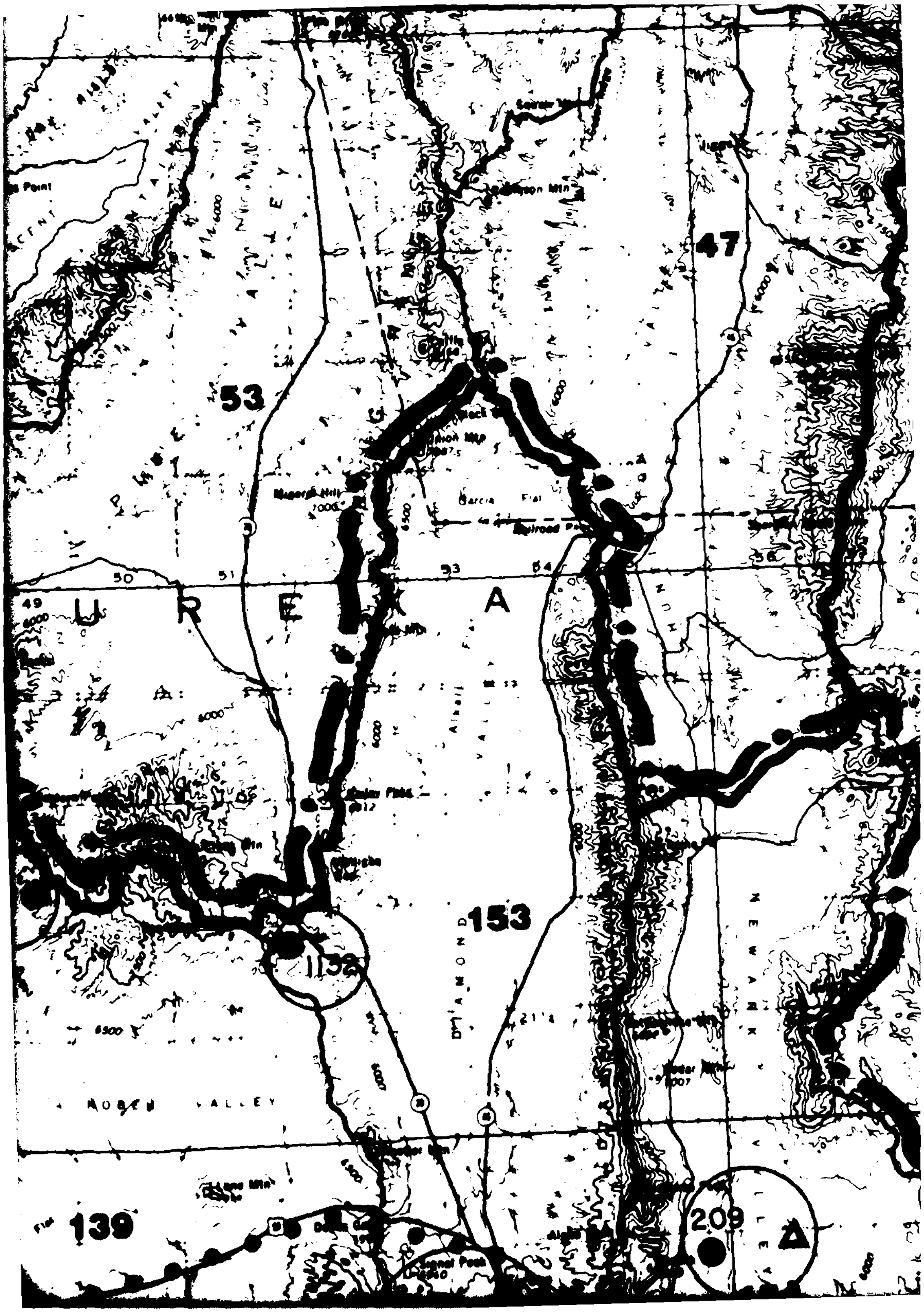
	1980	1981	1982	1983	1984	1985	1990	1995
AGRICULTURE								
Employment	35	→	→	→	→	→	→	35
Water Usage (ac. ft./yr.)	15,600	→	→	→	→	→	→	15,600
MINING/ENERGY								
Employment	2	→	→	→	→	→	→	2
Water Usage (ac. ft./yr.)	0	→	→	→	→	→	→	0
INDUSTRIAL/URBAN								
Employment	145	→	→	→	→	→	→	145
Water Usage (ac. ft./yr.)	198	→	→	→	→	→	→	198
TOTAL								
Employment	182	→	→	→	→	→	→	182
Water Usage	15,798	→	→	→	→	→	→	15,798
Population	595	→	→	→	→	→	→	595

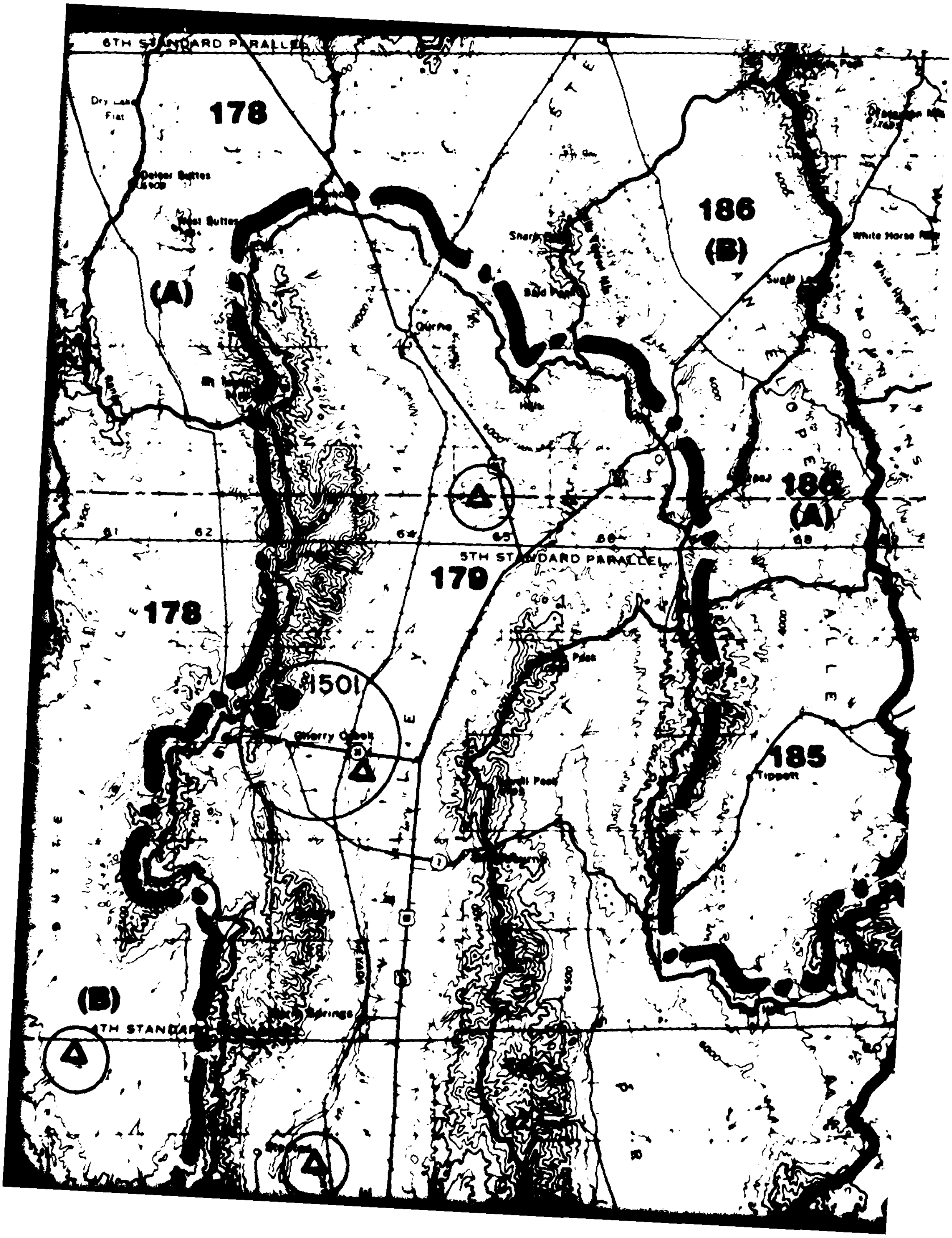


73
101
(A)
Lovelock
Lone Rock
Granite Point
Oreana
Woolsey
Chocolate Butte
Humboldt Sink
Ocala
Alkali Flat
Perran
CARSON
SINK
(Alkali Flat)
PARALLEL
Stillwater
C H U R C H I
101

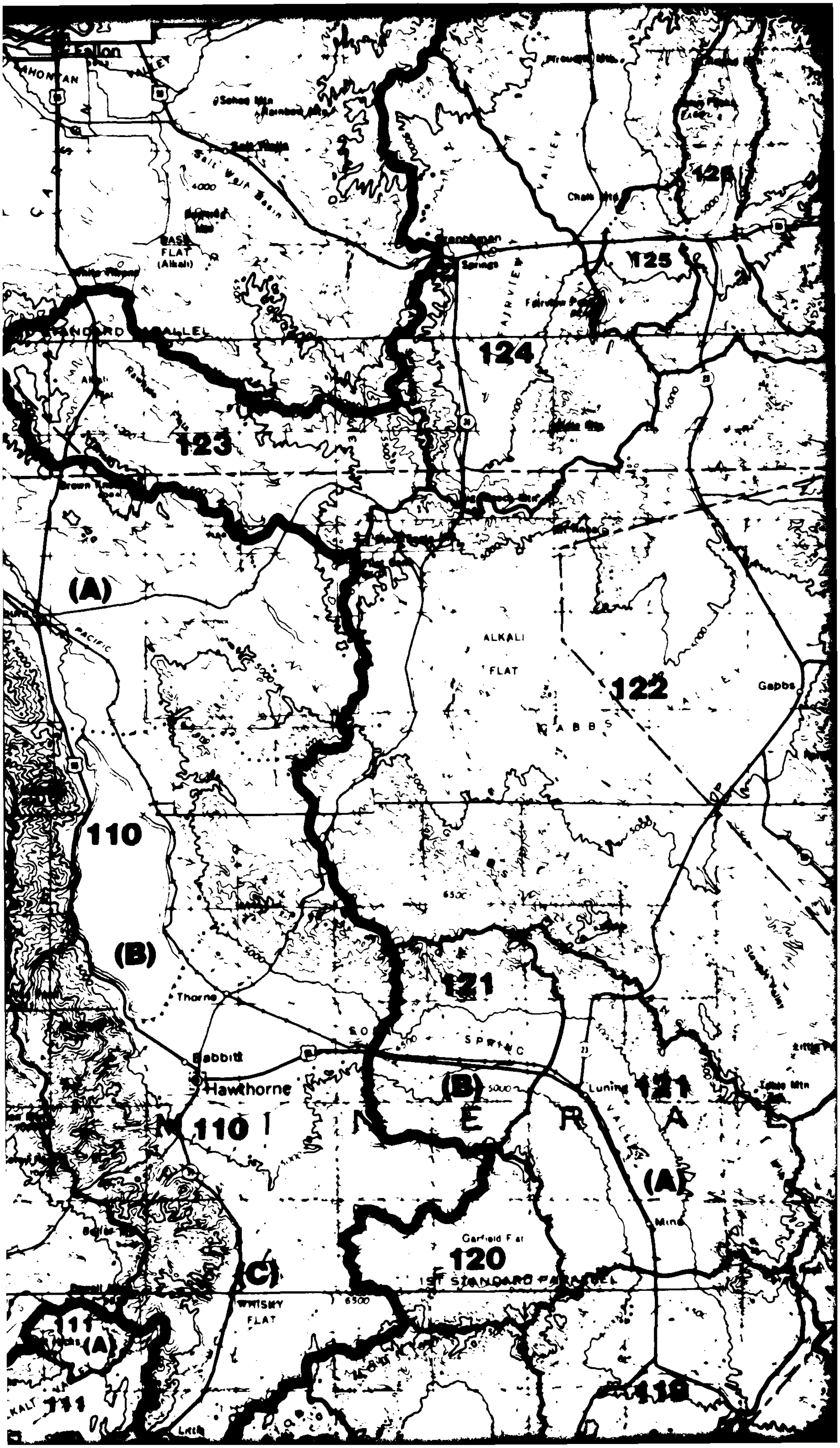


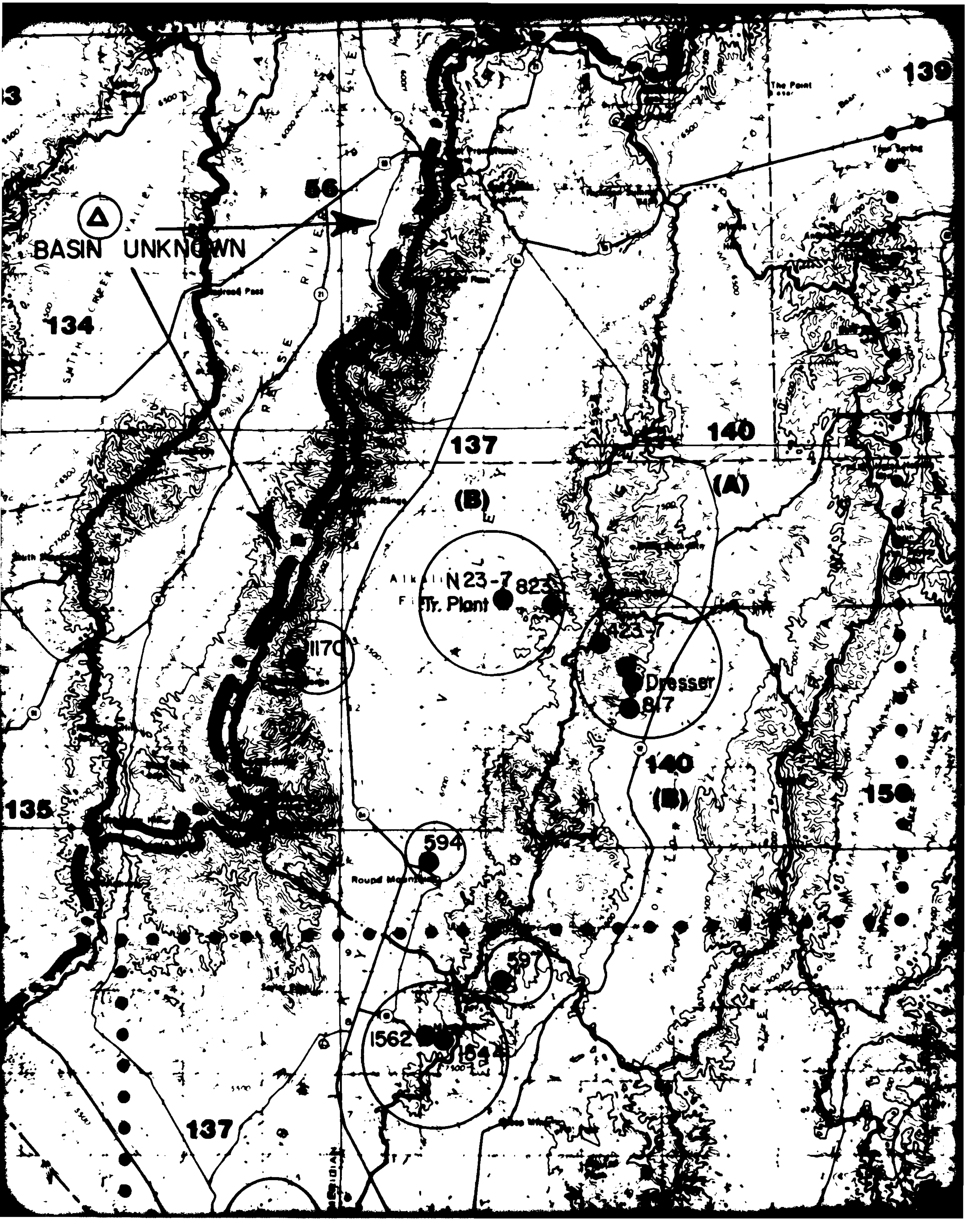
131
132
59
54
58
55
57
138
139
1551
Hot Springs Point
L A N D E R
E U
CRESCENT
ANTELOPE
CARICO LAKE
GRASS VALLEY
The Point


53
47
153
139
1132
209
E U R E K A
Garcia Flat
Railroad Pass
DIAMOND
VALLEY
NEWARK
ROBERTS VALLEY
Diamond Pass
Alkali Flat

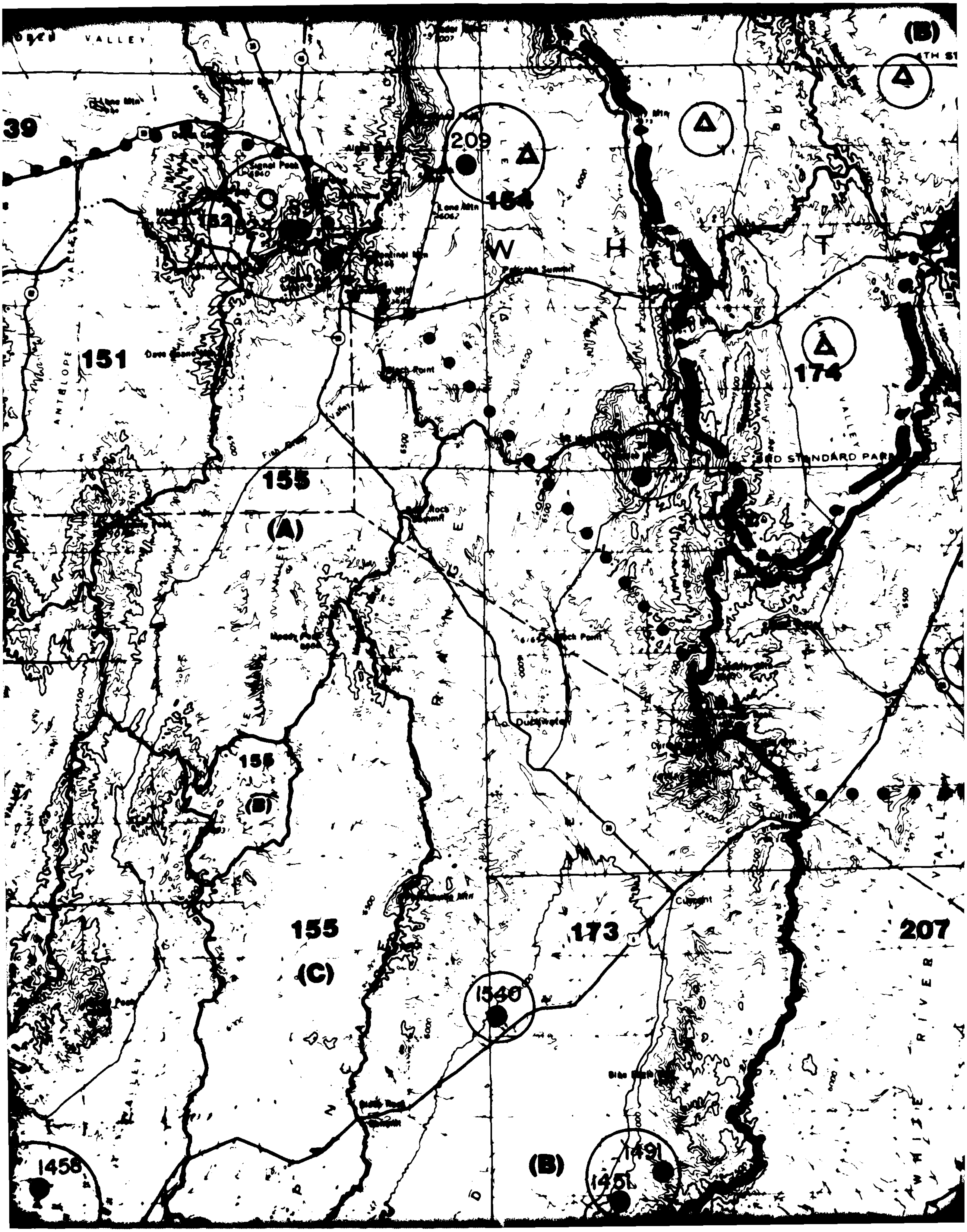


178
186
(B)
(A)
5TH STANDARD PARALLEL
179
178
186
(A)
185
Tippett
1501
Cherry Creek
(B)

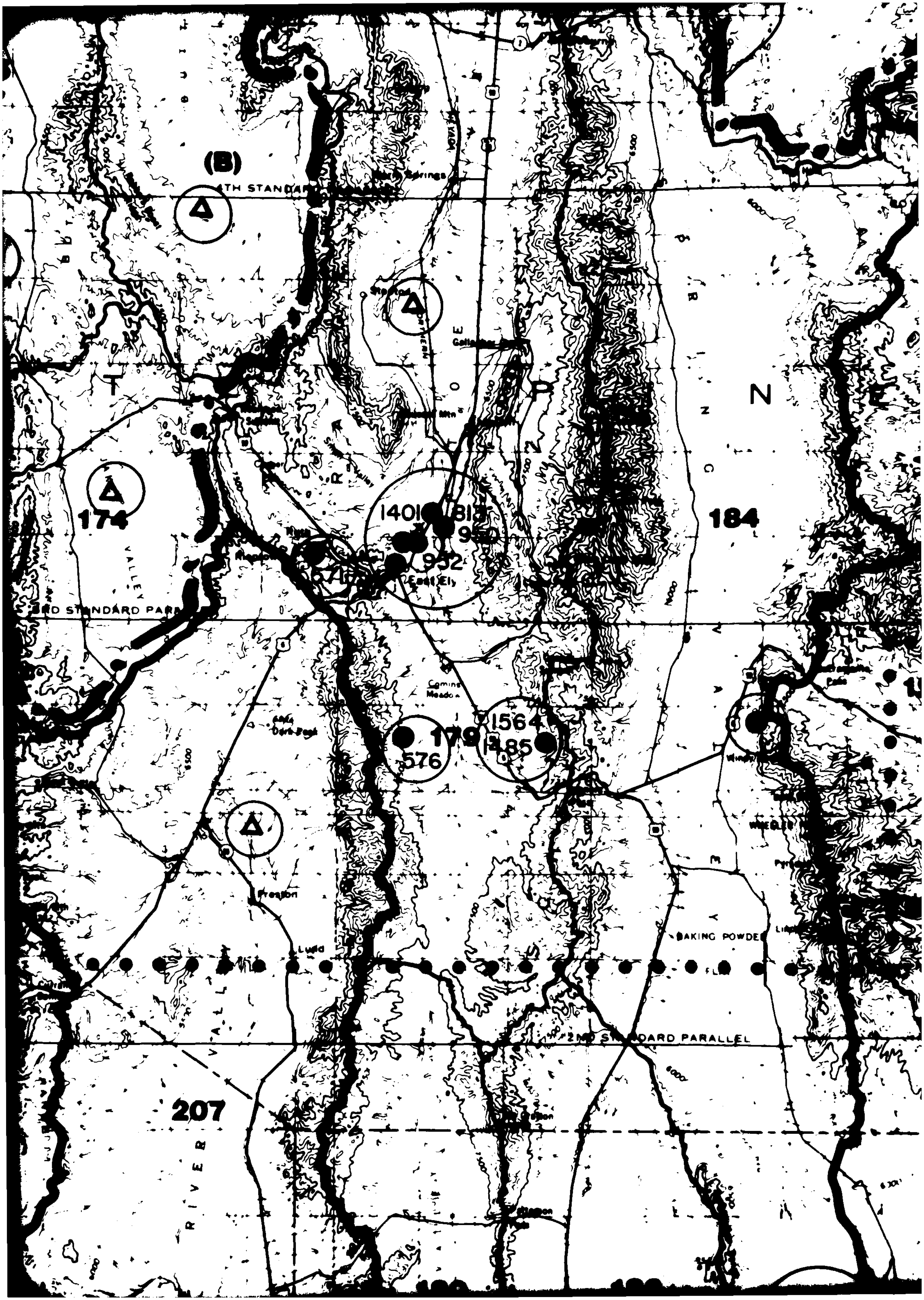

Fallon
123
124
125
122
ALKALI
FLAT
GABBS
Gabbs
(A)
110
(B)
Thorne
121
Babbitt
Hawthorne
(B)
Luning
121
(A)
110
Mina
Garfield Flat
120
(C)
WHISKY
FLAT
1ST STANDARD PARALLEL
119
111
(A)
111

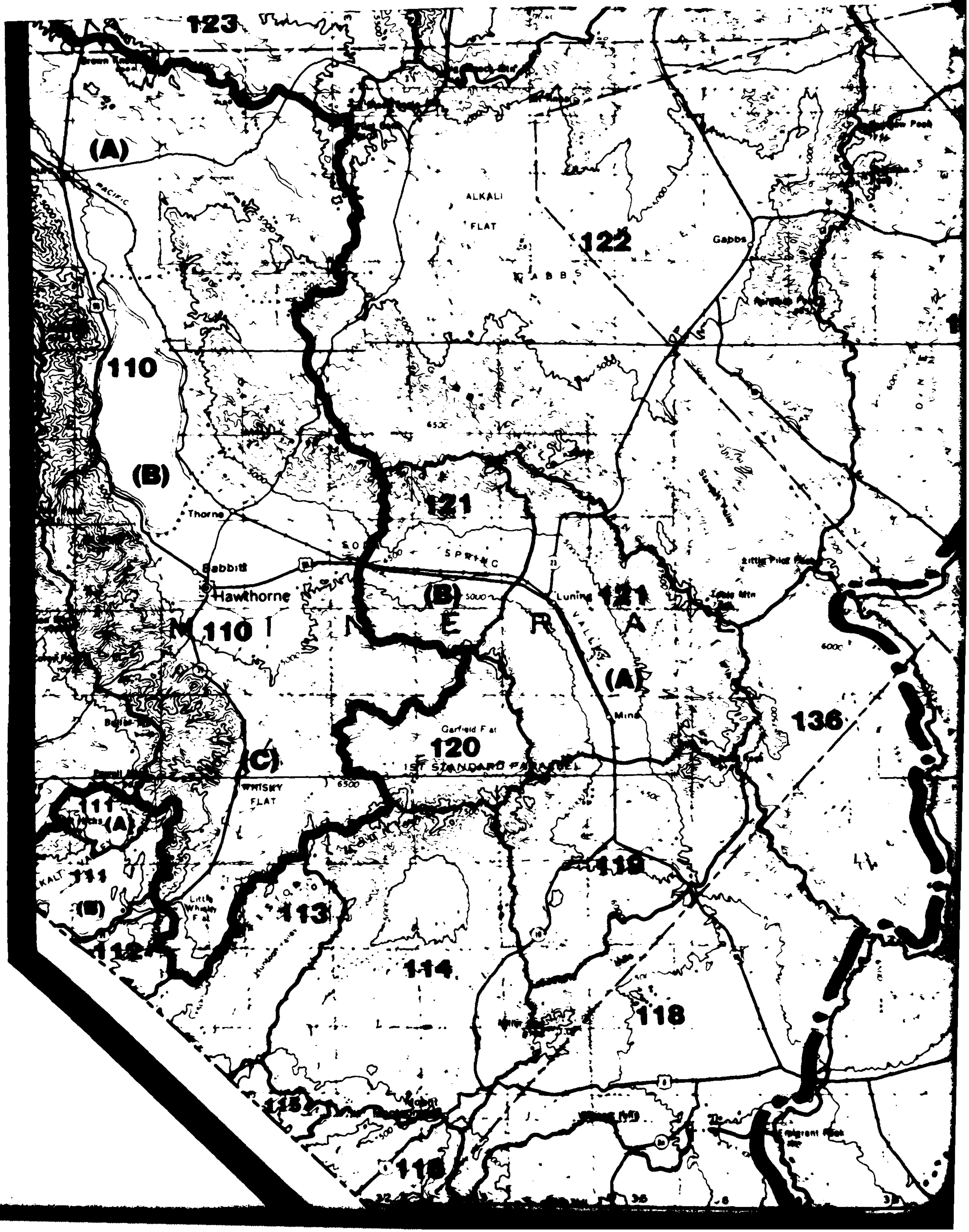


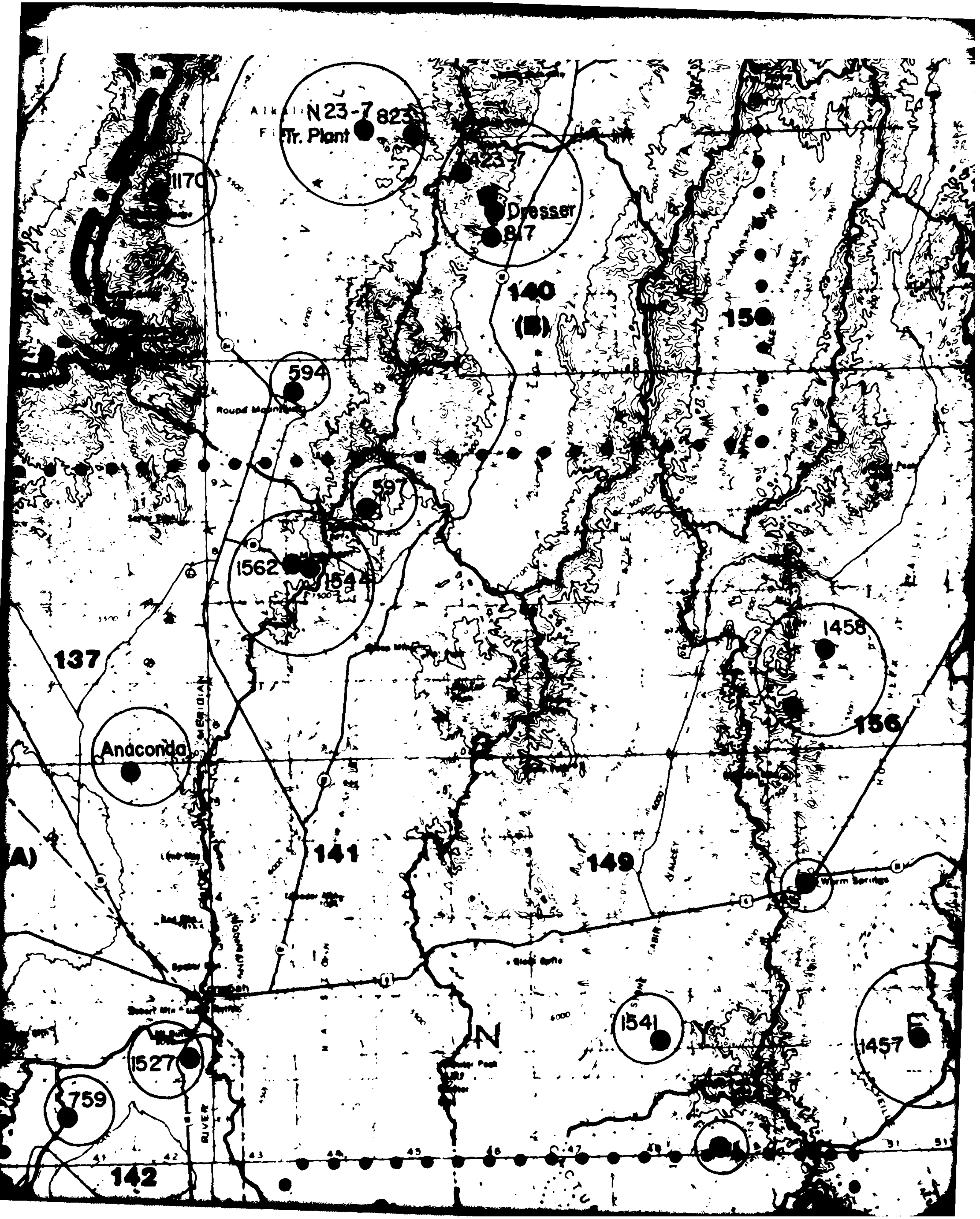
BASIN UNKNOWN
56
134
137
140
(A)
(B)
N 23-7
823
Tr. Plant
1170
423-7
Dresser
817
140
(B)
135
150
594
Round Mountain
597
1562
1544
137
139



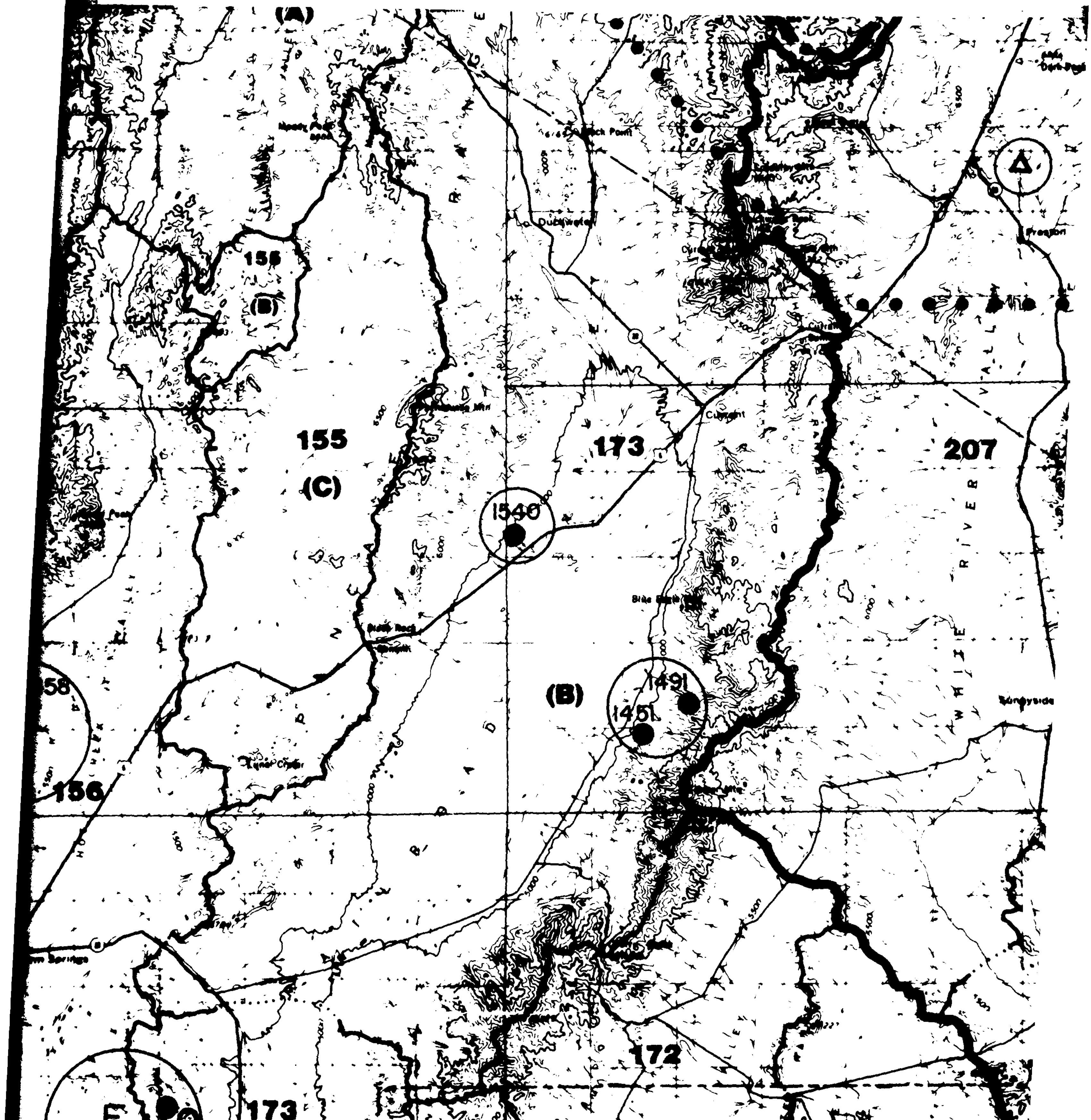
VALLEY
(B)
39
209
164
W
H
T
151
ANTELOPE VALLEY
155
(A)
174
VALLEY
3RD STANDARD PAR
155
(C)
173
207
1540
RIVER
1458
(B)
1491
1451

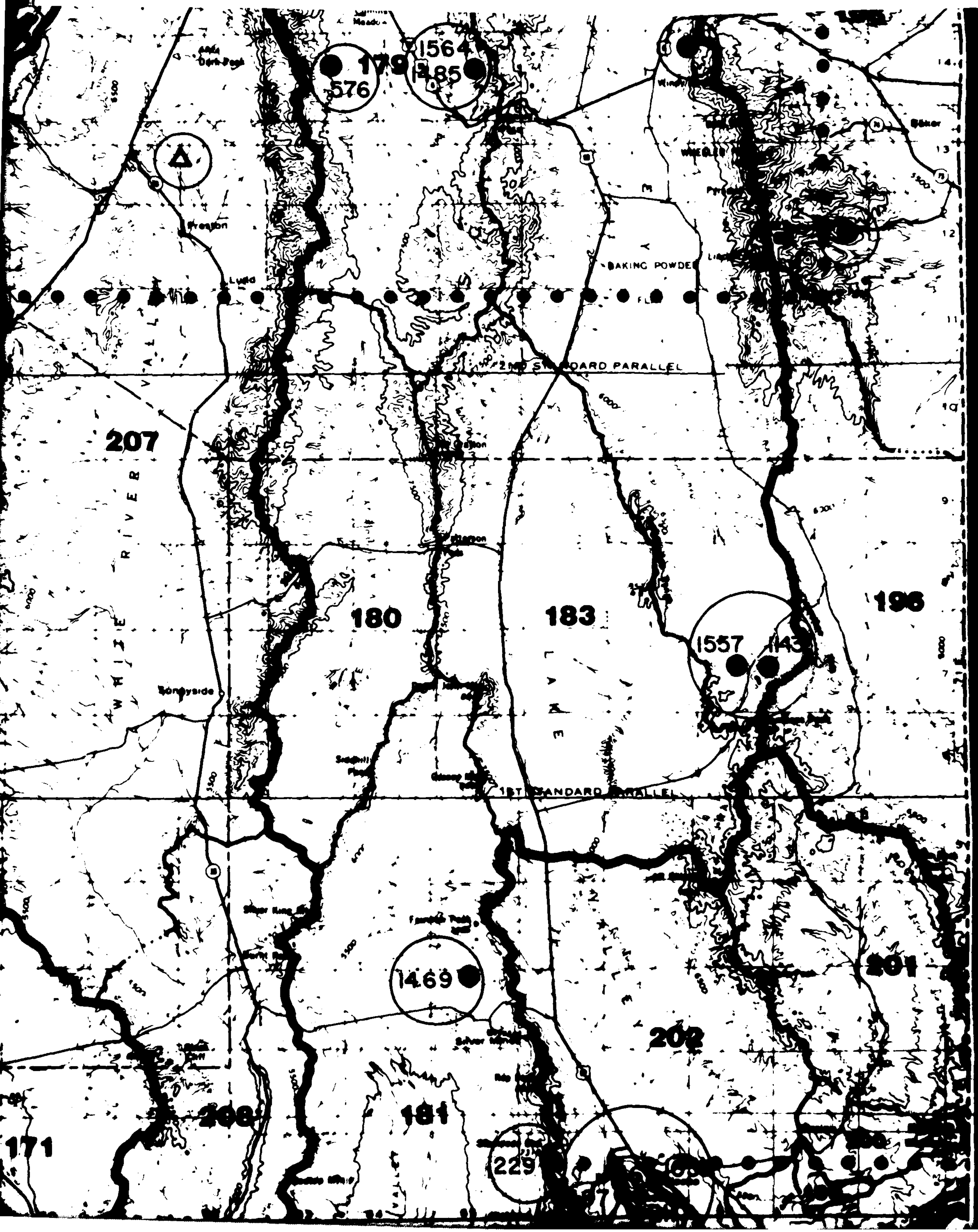

(B)
4TH STANDARD
174
184
1401
813
950
952
East Ely
574
1564
1485
179
576
207
BAKING POWDER
2ND STANDARD PARALLEL
3RD STANDARD PARALLEL
VALLEY
RIVER
N
Preston
Lund
Wheeler


123
(A)
110
(B)
Thorne
Babbitt
Hawthorne
110
(C)
WHISKY
FLAT
ALKALI
FLAT
122
Gabbs
121
SPRING
(B)
Luning
121
(A)
Mina
136
Garfield Flat
120
1ST STANDARD PARALLEL
111
(A)
111
Little
Whisky
Flat
113
112
114
119
118
115
115

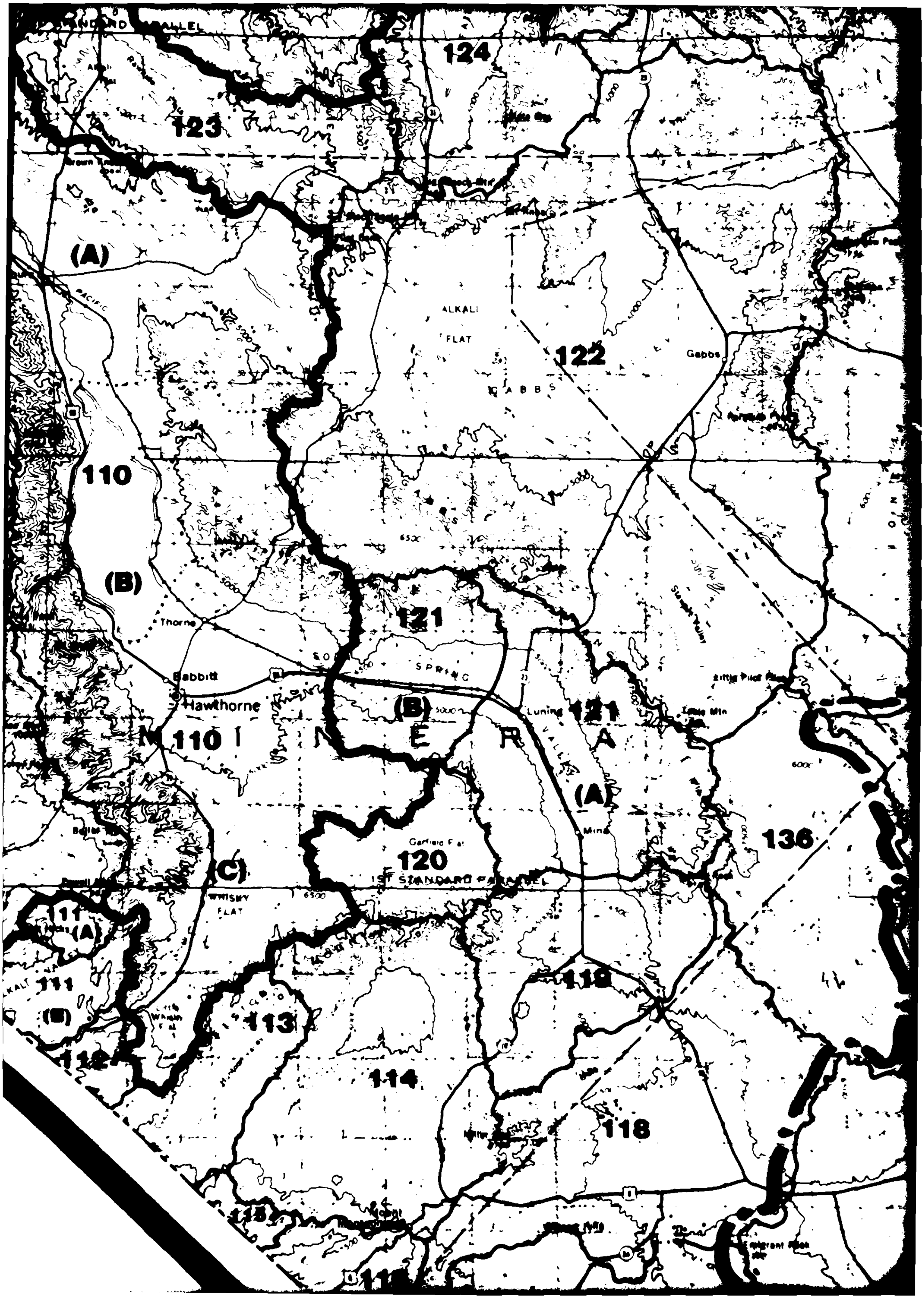


N 23-7
823
Tr. Plant
1170
423-7
Dresser
817
140
(B)
150
594
Round Mountain
597
1562
1544
137
Anaconda
141
149
1458
156
Warm Springs
(A)
1527
759
142
1541
1457

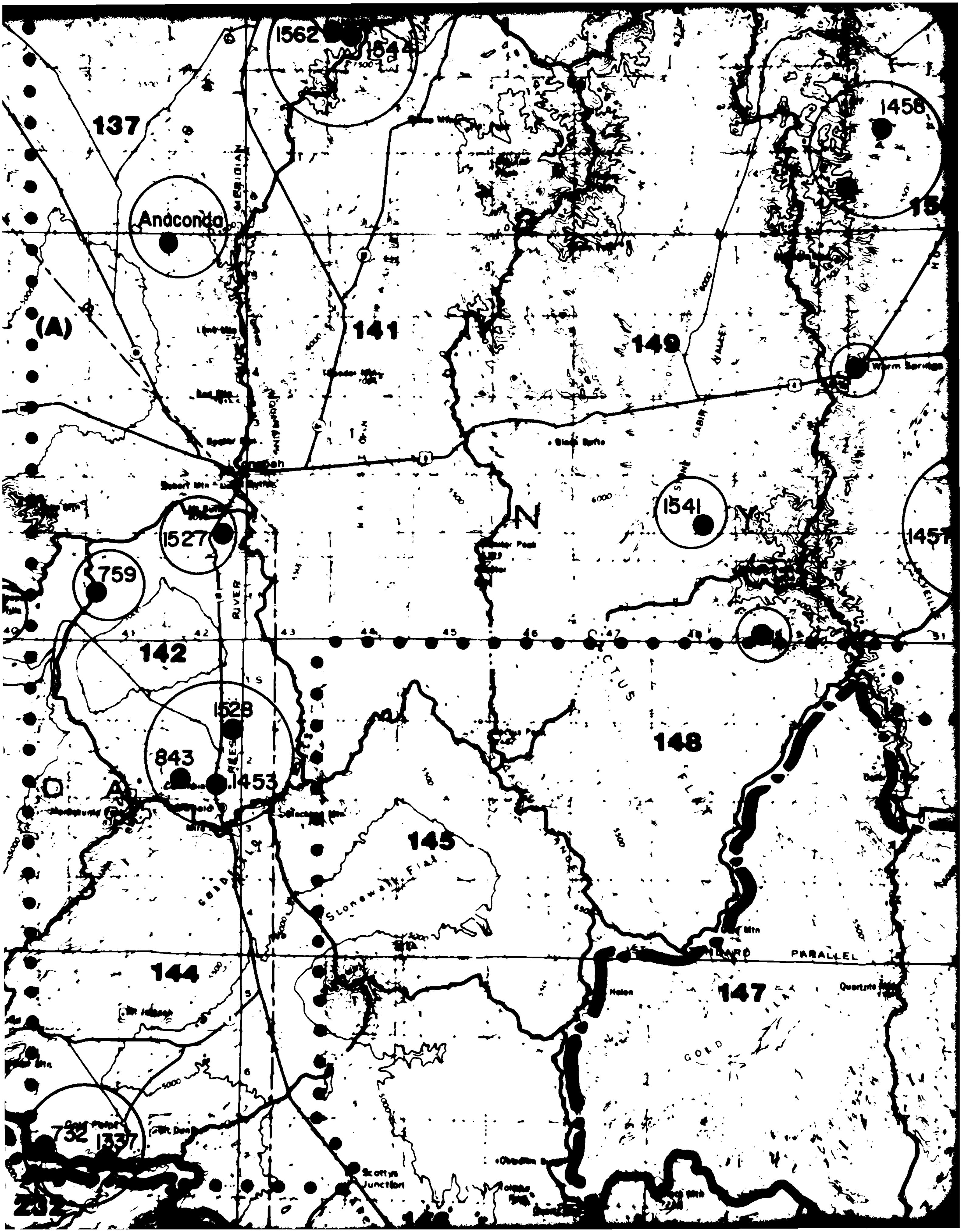

(A)
155
(B)
155
(C)
173
207
1540
1491
1451
(B)
156
173
172
171
1457
Duckwater
Currant
Sunnyside
Blue Eagle
Tyner Creek
Preston



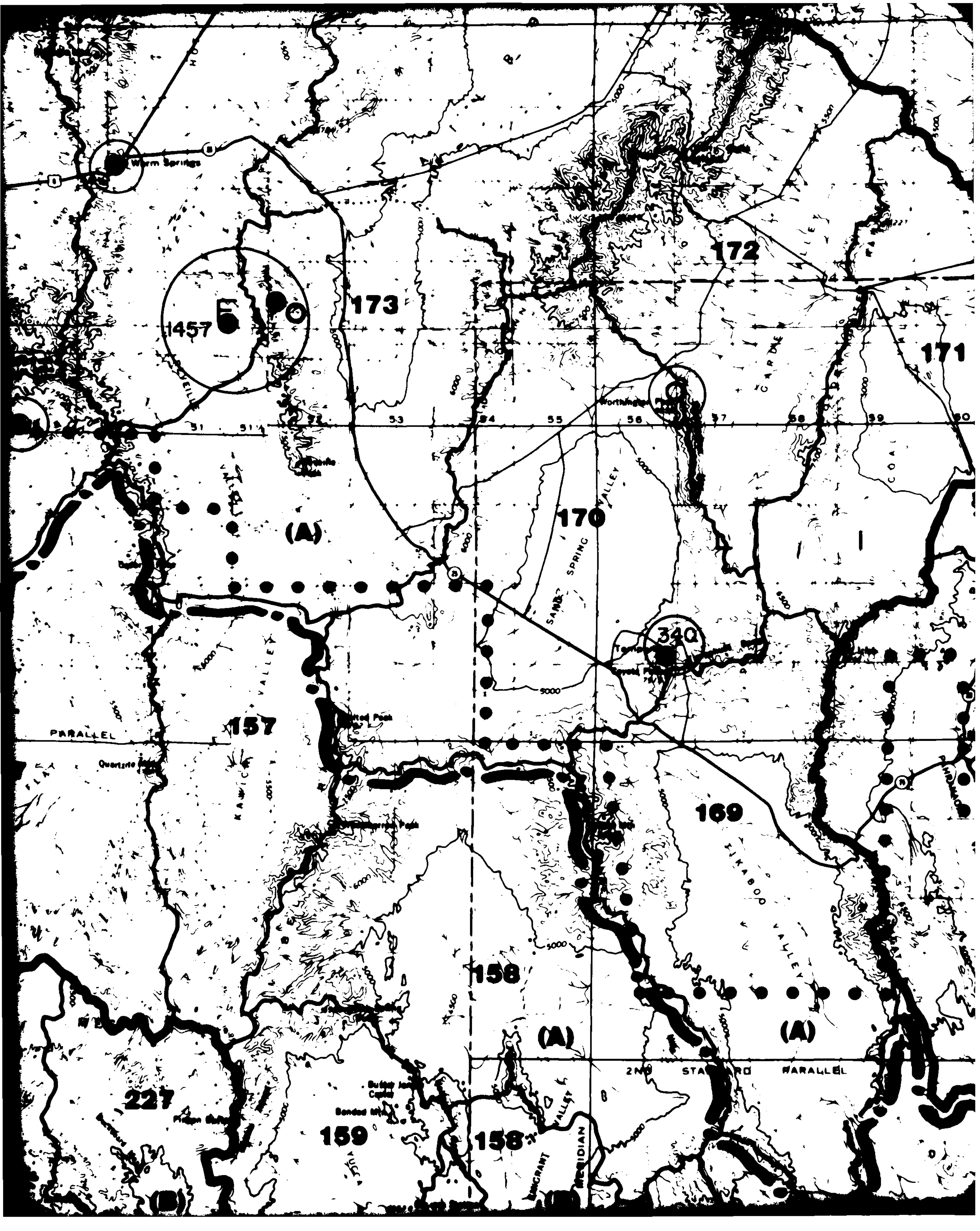
1564
1485
179
576
Preston
Lund
BAKING POWDER
2ND STANDARD PARALLEL
1ST STANDARD PARALLEL
207
180
183
196
1557
143
Sunnyside
1469
201
202
181
206
171
229
WHITE RIVER VALLEY
LAKE



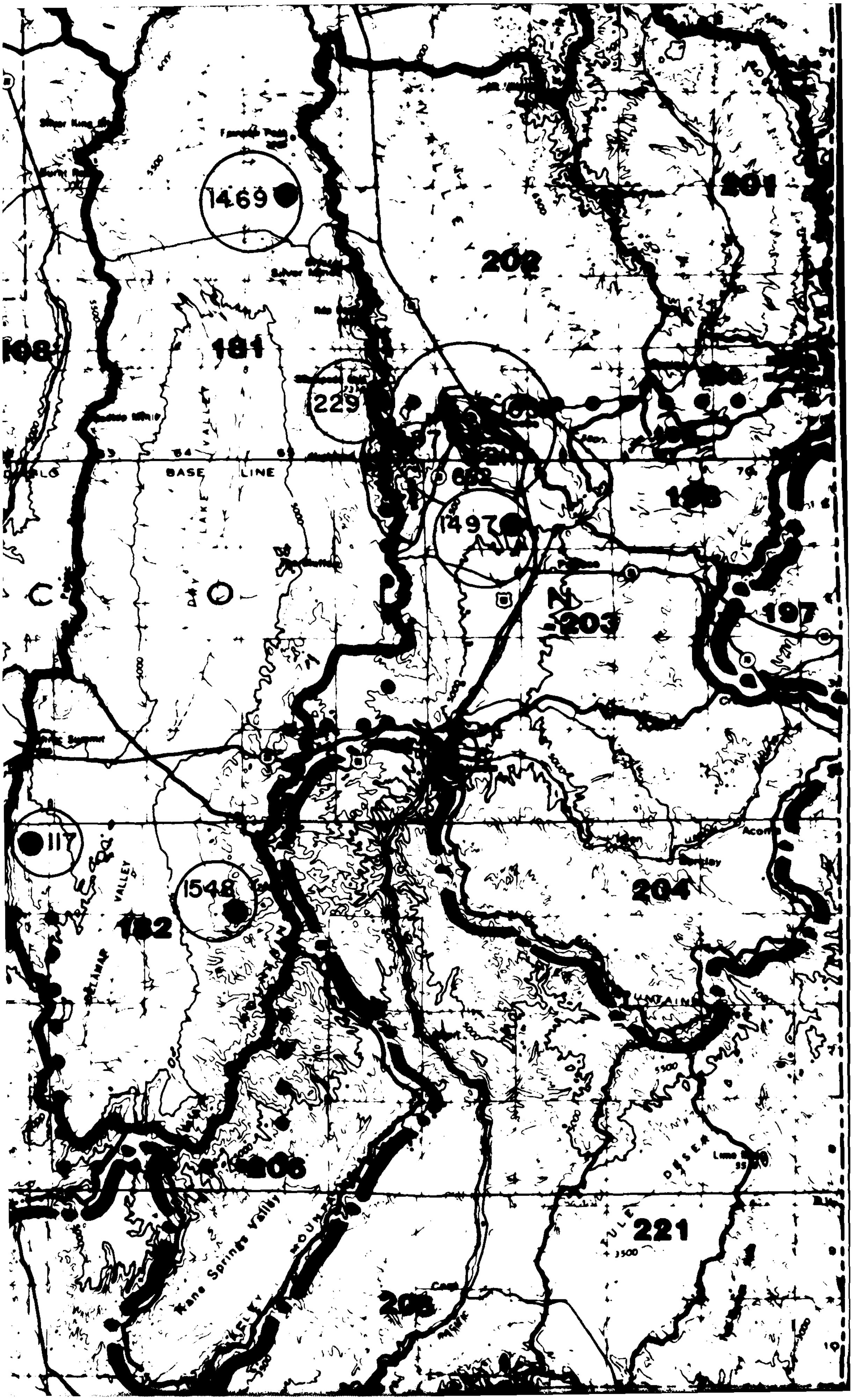
124
123
(A)
ALKALI
FLAT
122
Gabbs
GABBS
110
(B)
Thorne
121
Babbitt
Hawthorne
SPRING
(B)
Luning
121
M 110 I N E R A L
(A)
Mina
Garfield Flat
120
(C)
1ST STANDARD PARALLEL
WHISKY
FLAT
136
111
(A)
111
119
113
114
118



137
1562
1544
1458
Anaconda
(A)
141
149
Warm Springs
MERIDIAN
1541
N
1527
759
1457
142
RIVER
148
1528
843
1453
145
Stonewall Flat
PARALLEL
144
147
GOLD
732
1337
Scottys Junction



173
172
171
170
169
157
158
159
227
1457
340
(A)
(A)
(A)
Warm Springs
SAND SPRING VALLEY
KAWICH VALLEY
TIKABOO VALLEY
GARDEN VALLEY
COAL VALLEY
PARALLEL
2ND STANDARD PARALLEL
MERIDIAN
EMIGRANT VALLEY


1469
201
202
181
229
BASE LINE
1497
203
197
117
1548
182
204
206
221
205
Kane Springs Valley

Water Resources Center
Desert Research Institute

PLATE 2 Index map of water consuming mining and energy facility sites in the proposed MX area and vicinity, Nevada.

LEGEND

● EXISTING OR PLANNED MINES OR MILLS
NUMBERS REFER TO MINE INSPECTOR'S I.D. NUMBER

○ EXISTING OR PLANNED MINES OR MILLS
UNCERTAIN OF EXACT LOCATION

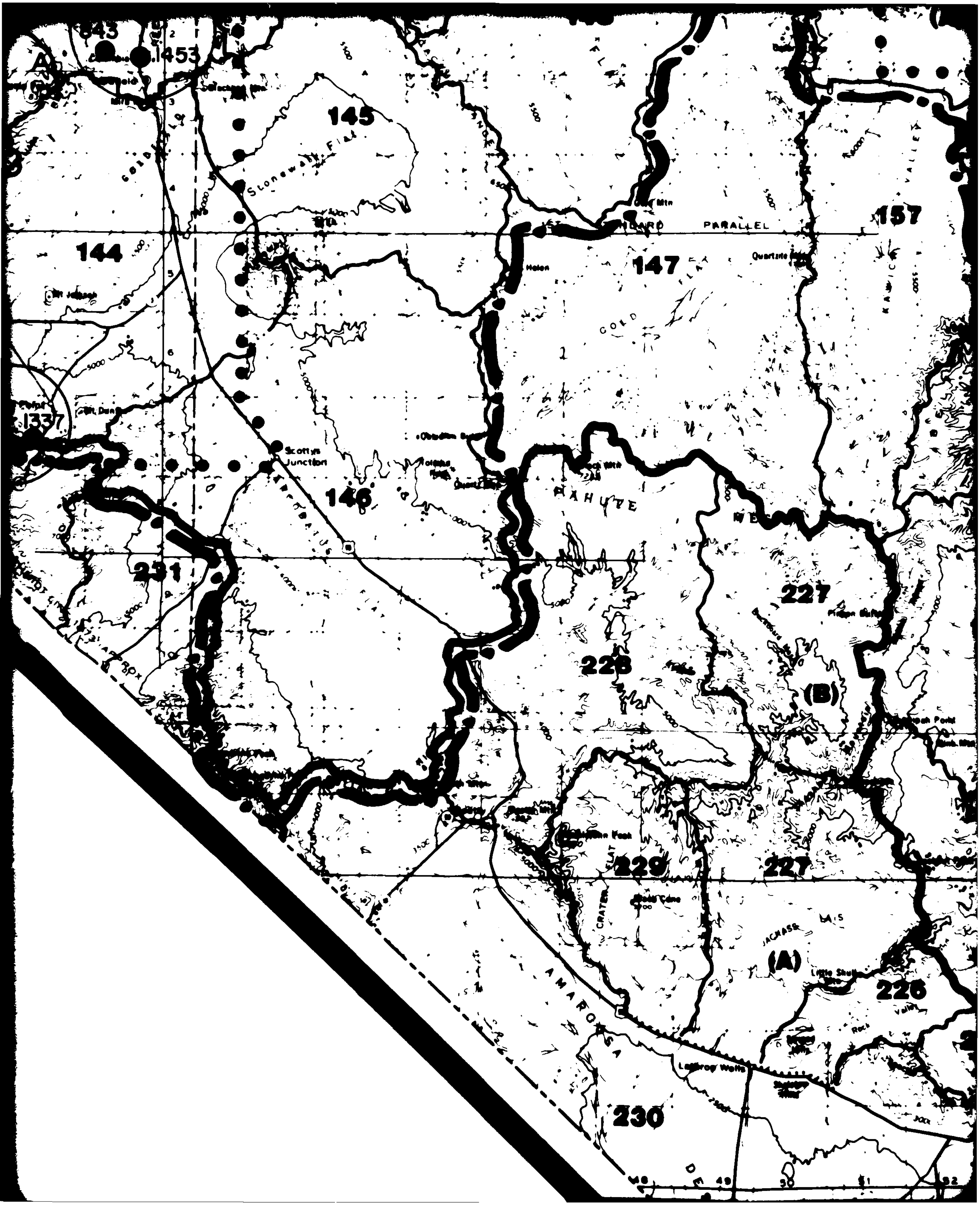
△ POSSIBLE SITES FOR PROPOSED FOSSIL FUEL
ELECTRICAL POWER GENERATING PLANTS

■ EXISTING OR PLANNED GEOTHERMAL SITES
(See Caliente)

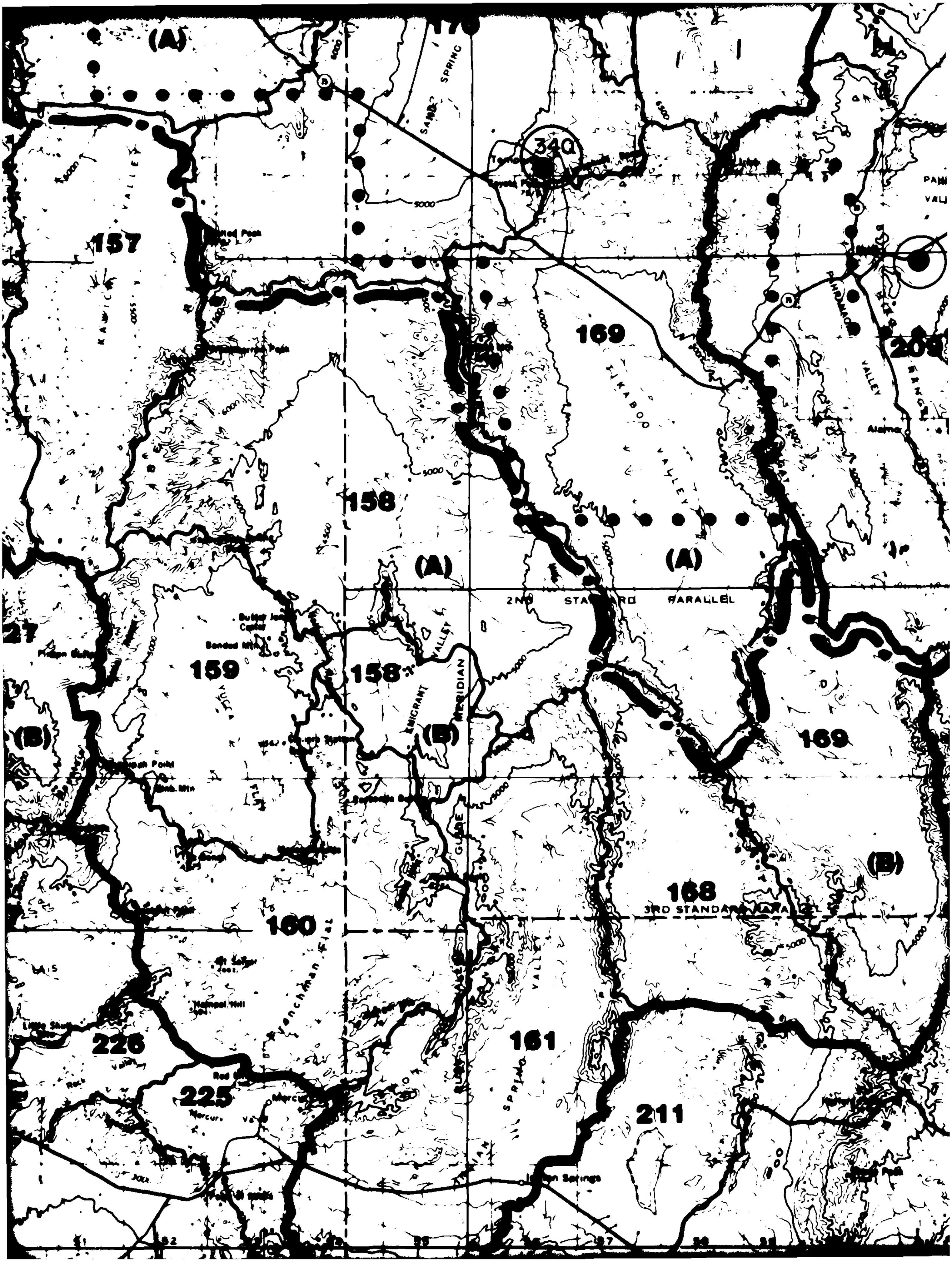
• ▬ INVENTORY REGION BOUNDARY

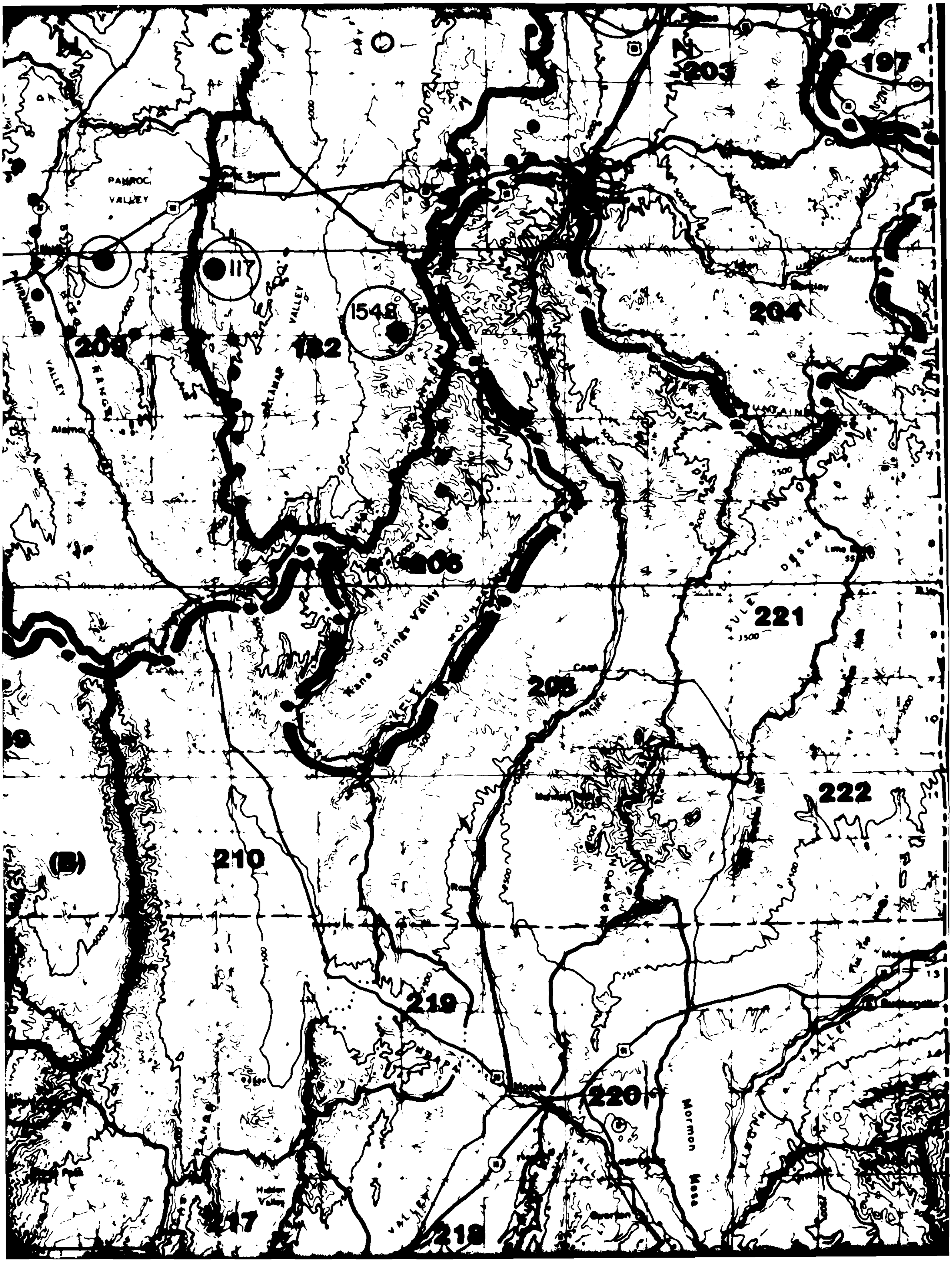
••• MX SITING BOUNDARY

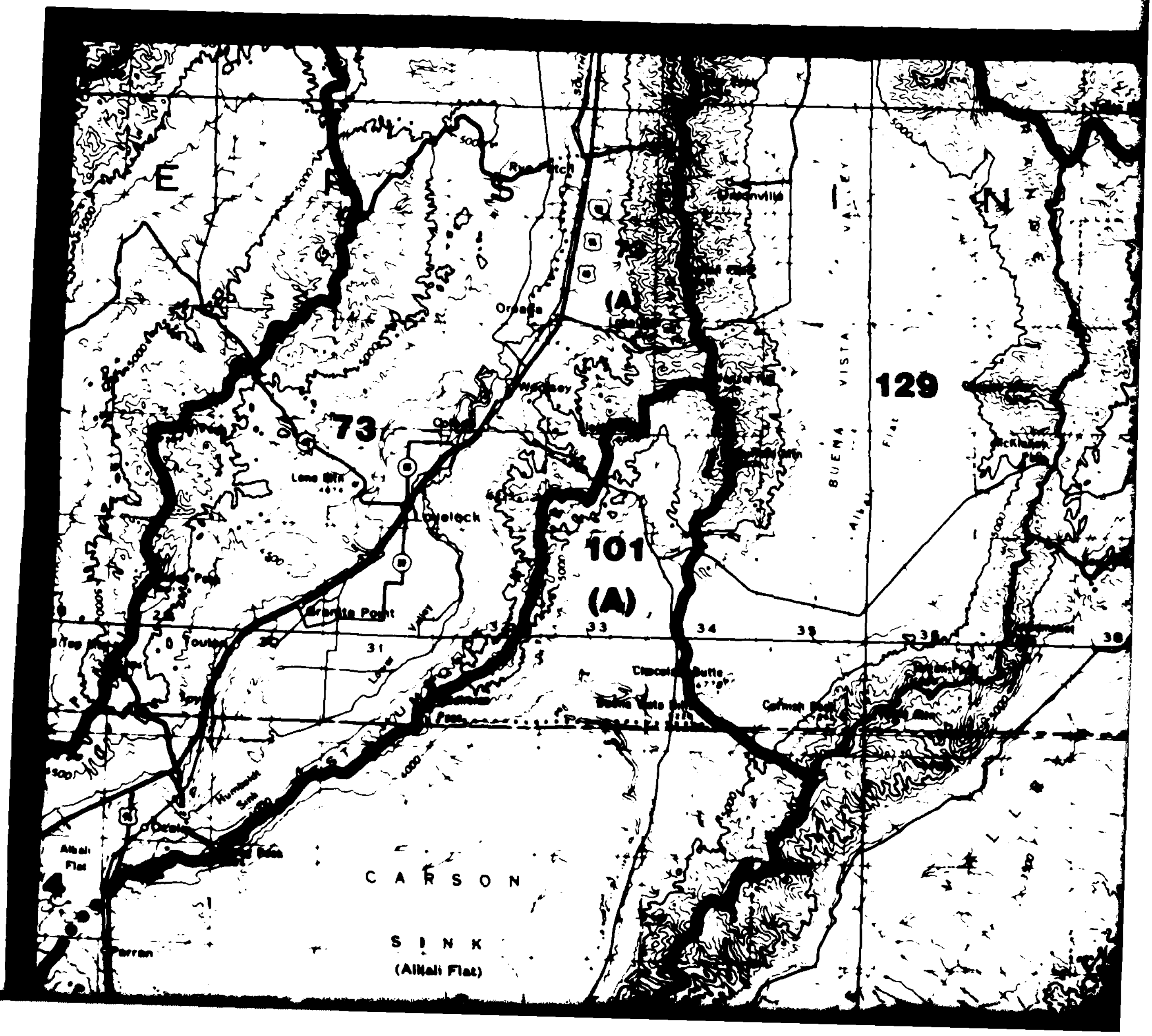
Mining and energy compilation by Geothermal Development Associates



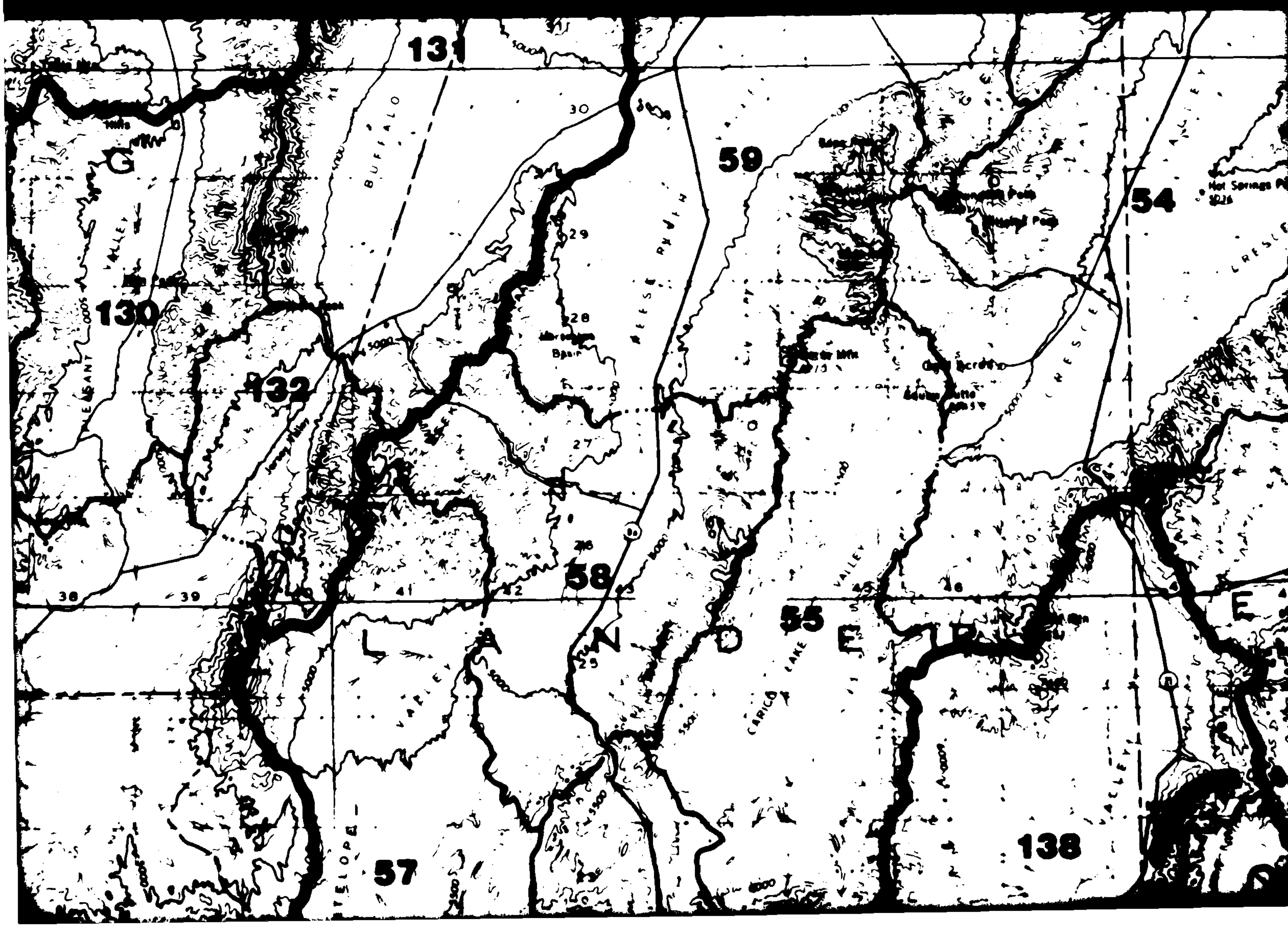
145
Stonewall Flat
144
147
157
PARALLEL
Helen
GOLD
Scottys Junction
146
PAHUTE
231
228
227
(B)
229
227
CRATER FLAT
JACKASS
(A)
226
AMARGOSA
Lathrop Wells
230
1453
1337


(A)
340
157
169
158
(A)
(A)
2ND STANDARD PARALLEL
159
158
(B)
(B)
169
(B)
168
3RD STANDARD PARALLEL
160
226
225
161
211
KAWICH VALLEY
SAND SPRING
TIKABOO VALLEY
EMIGRANT VALLEY
MERIDIAN
YUCCA FLAT
Frenchman Flat
SPRING VALLEY
Indian Springs


PAHROC
VALLEY
117
1548
209
182
VALLEY
Alamo
206
204
203
197
Kane Springs Valley
221
222
205
210
(B)
219
220
217
218
Hidden
Valley
Mormon
Mesa

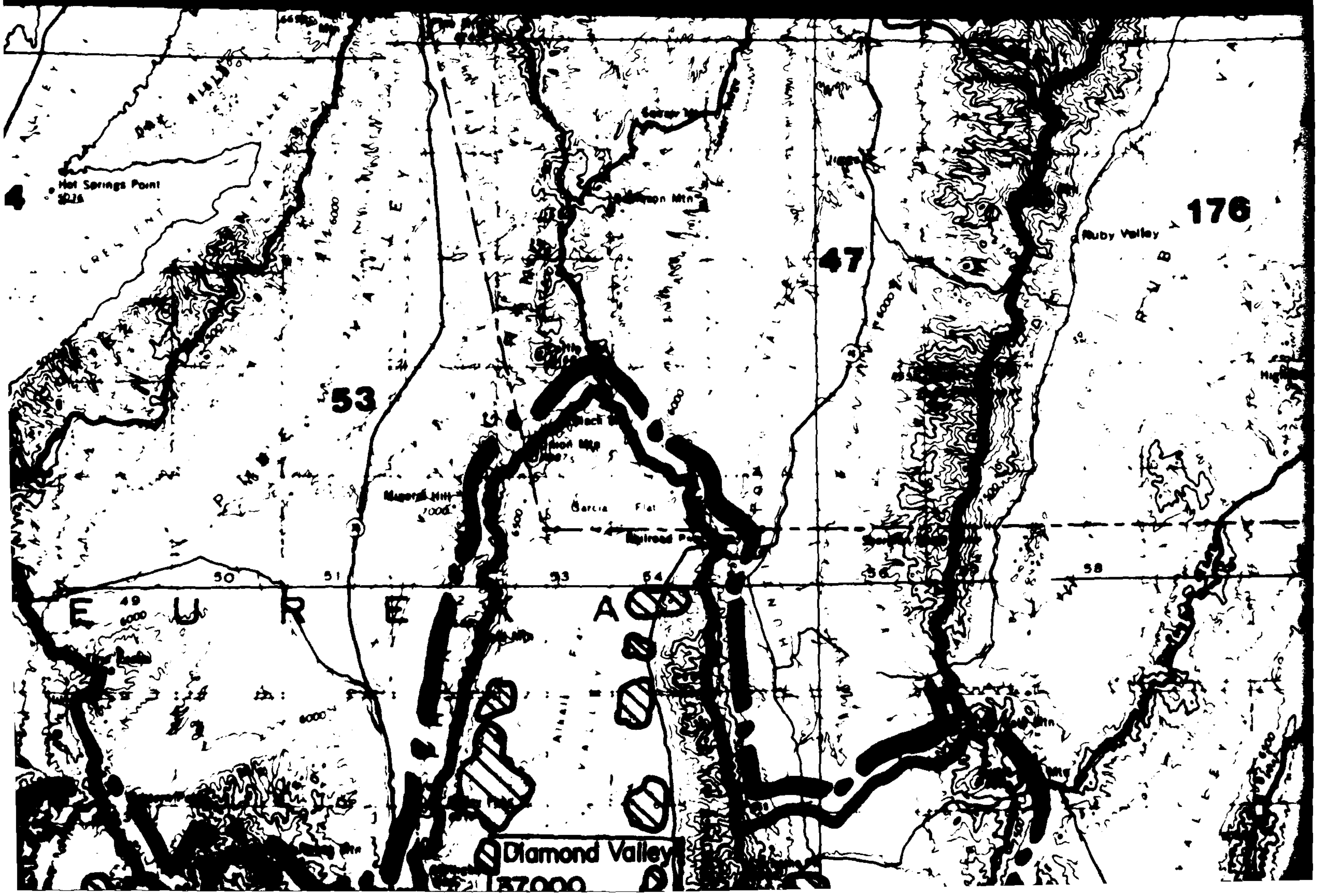


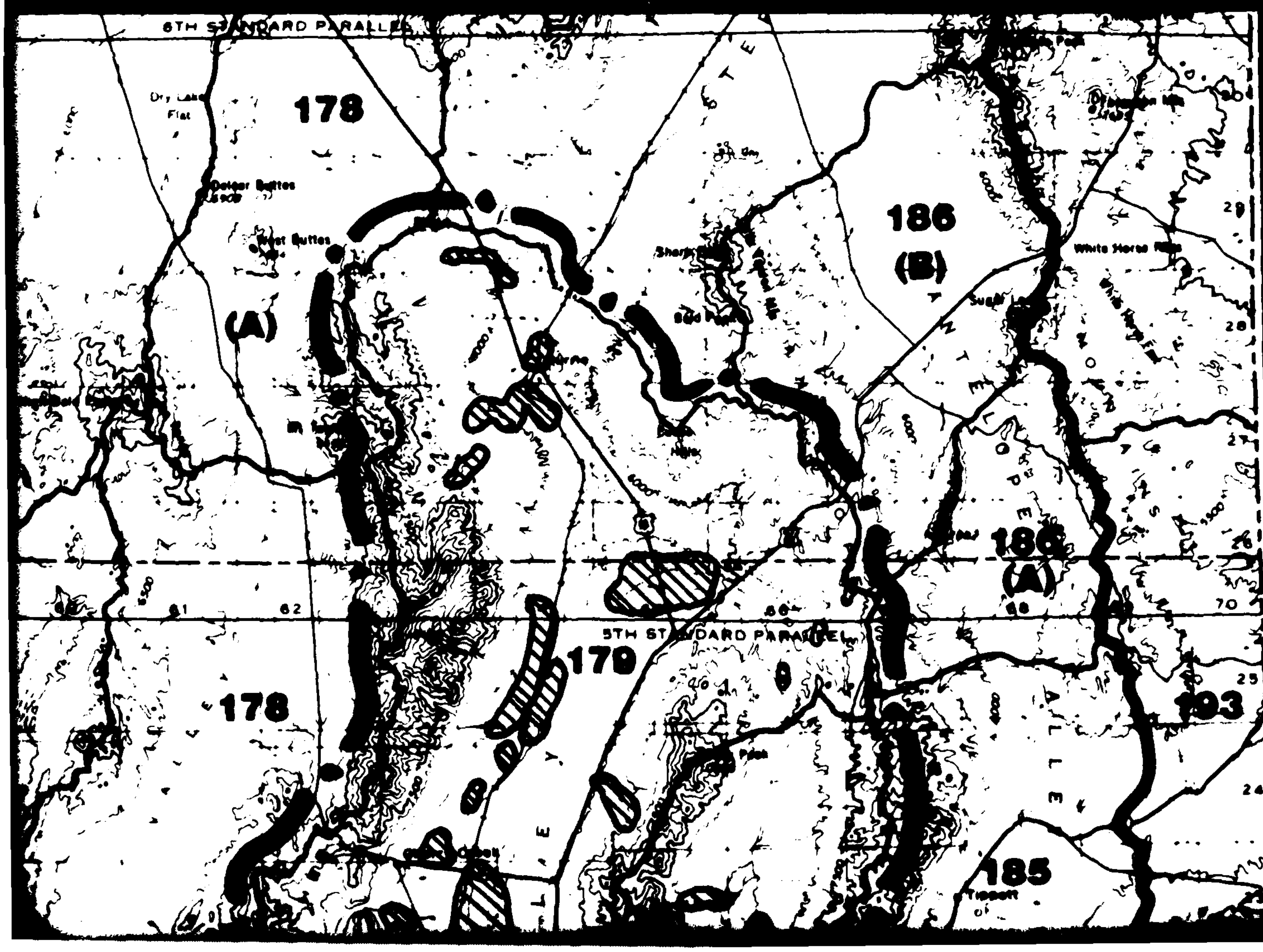
73
101
(A)
129
Lovelock
Oreana
Woolsey
Granite Point
Toulon
Humboldt Sink
Buena Vista Valley
Chocolate Butte
C A R S O N
S I N K
(Alkali Flat)
Alkali Flat
Parran
31
33
34
35
38

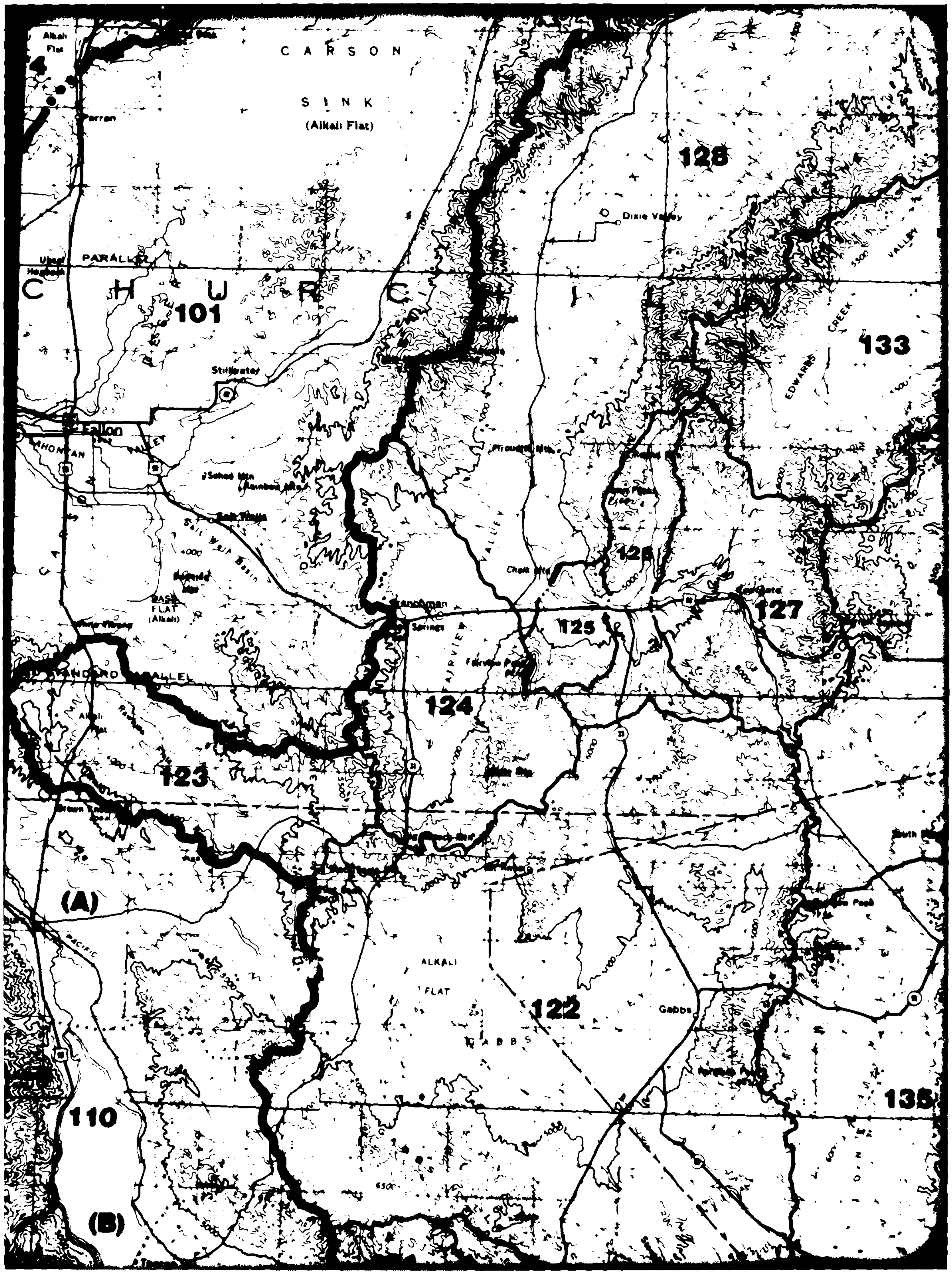


131
59
54
G
130
132
58
55
57
138
BUFFALO
L A N D E R

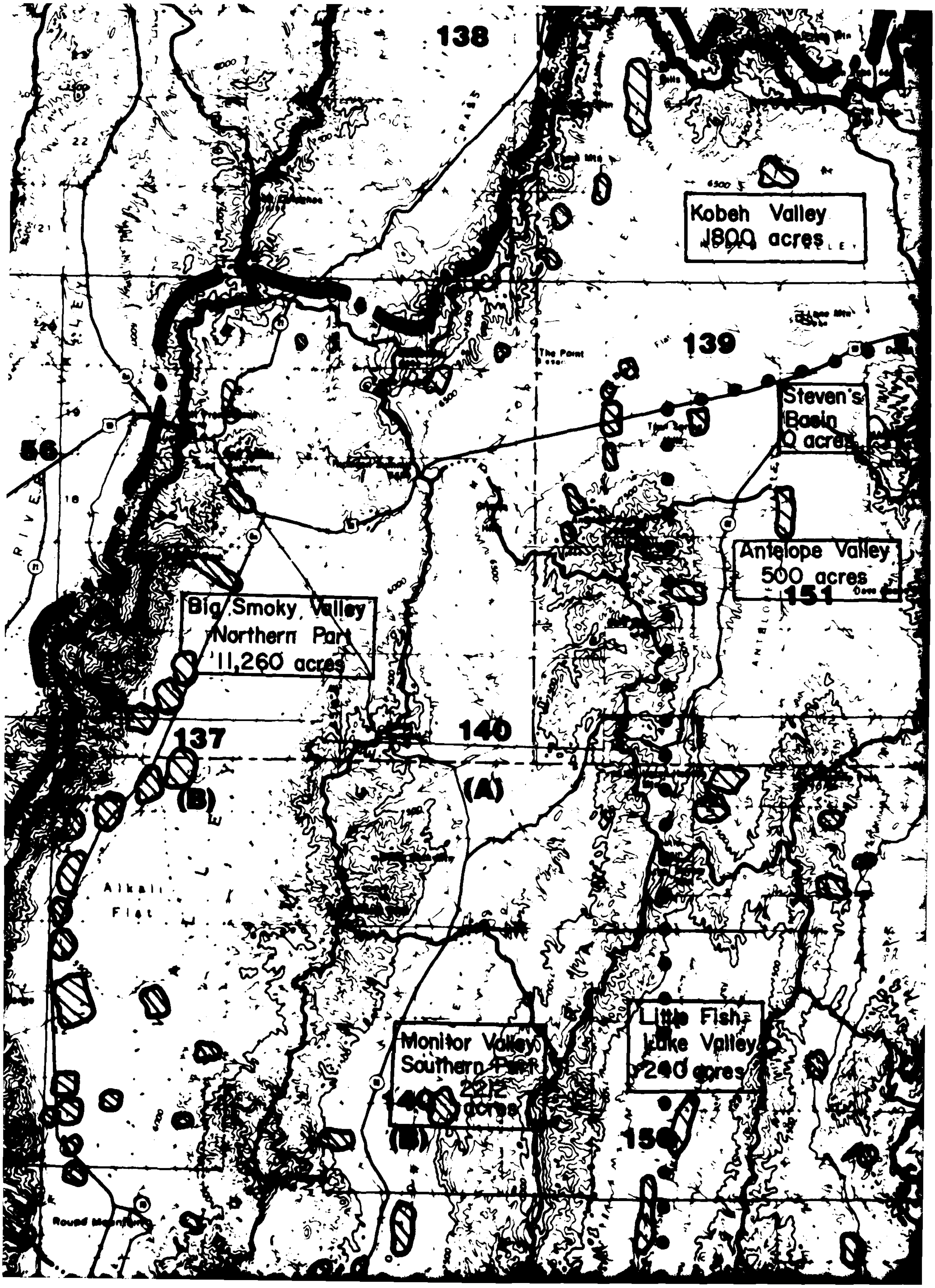
3

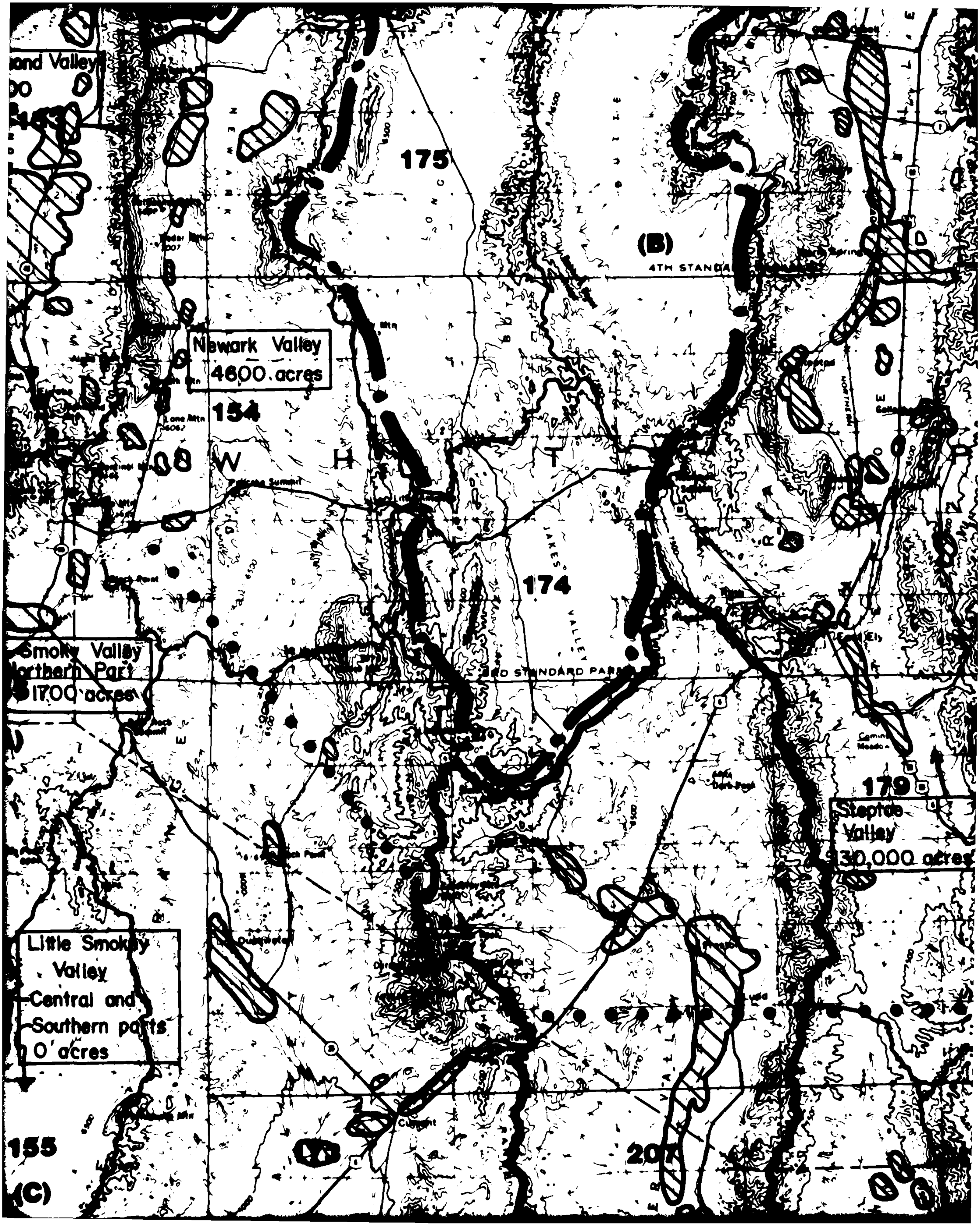

Hot Springs Point
53
47
176
Ruby Valley
Garcia Flat
Railroad Pass
E U R E K A
Diamond Valley


178
186
(B)
(A)
186
(A)
179
178
185
70
24
25
27
28
29

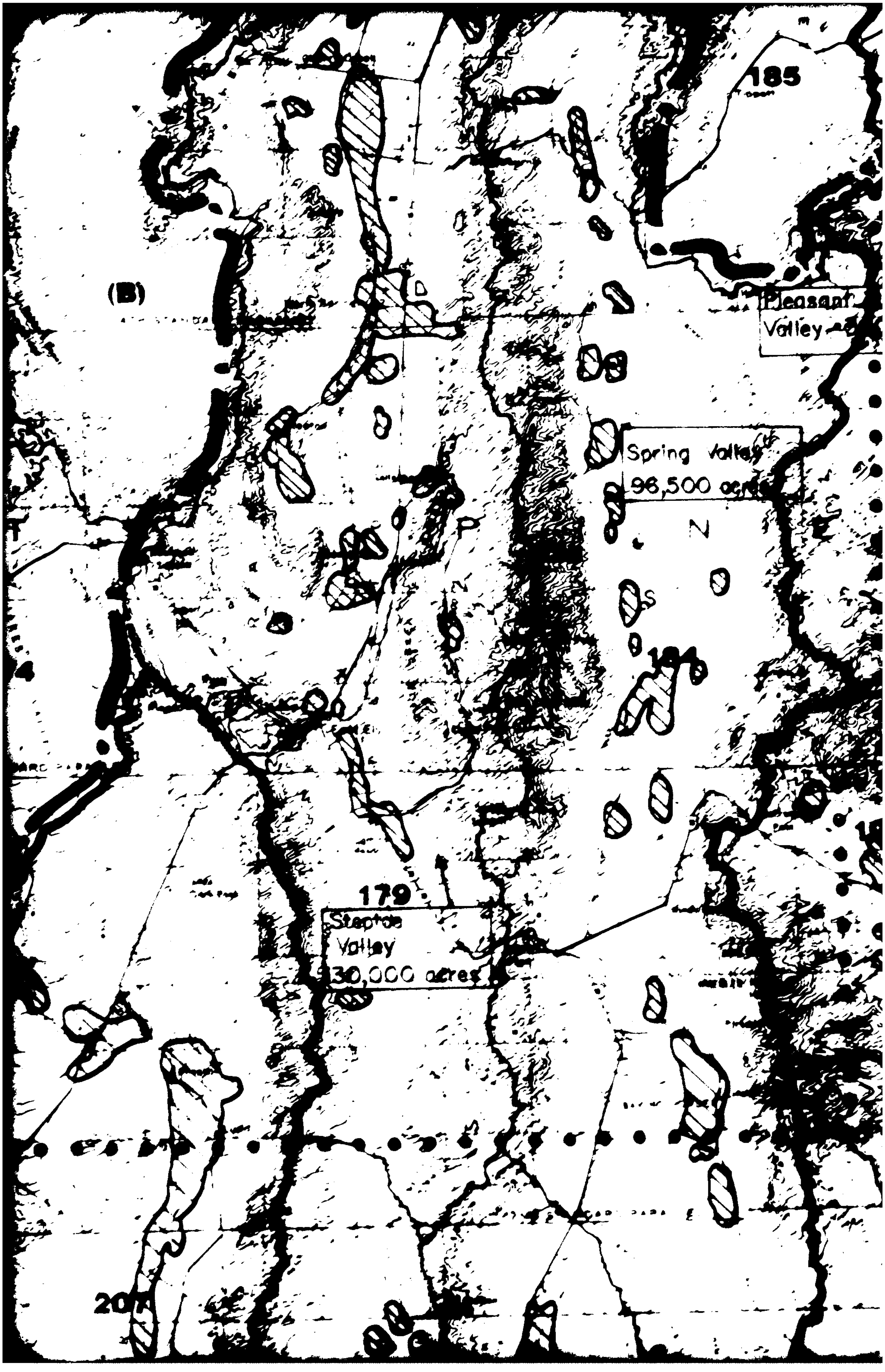


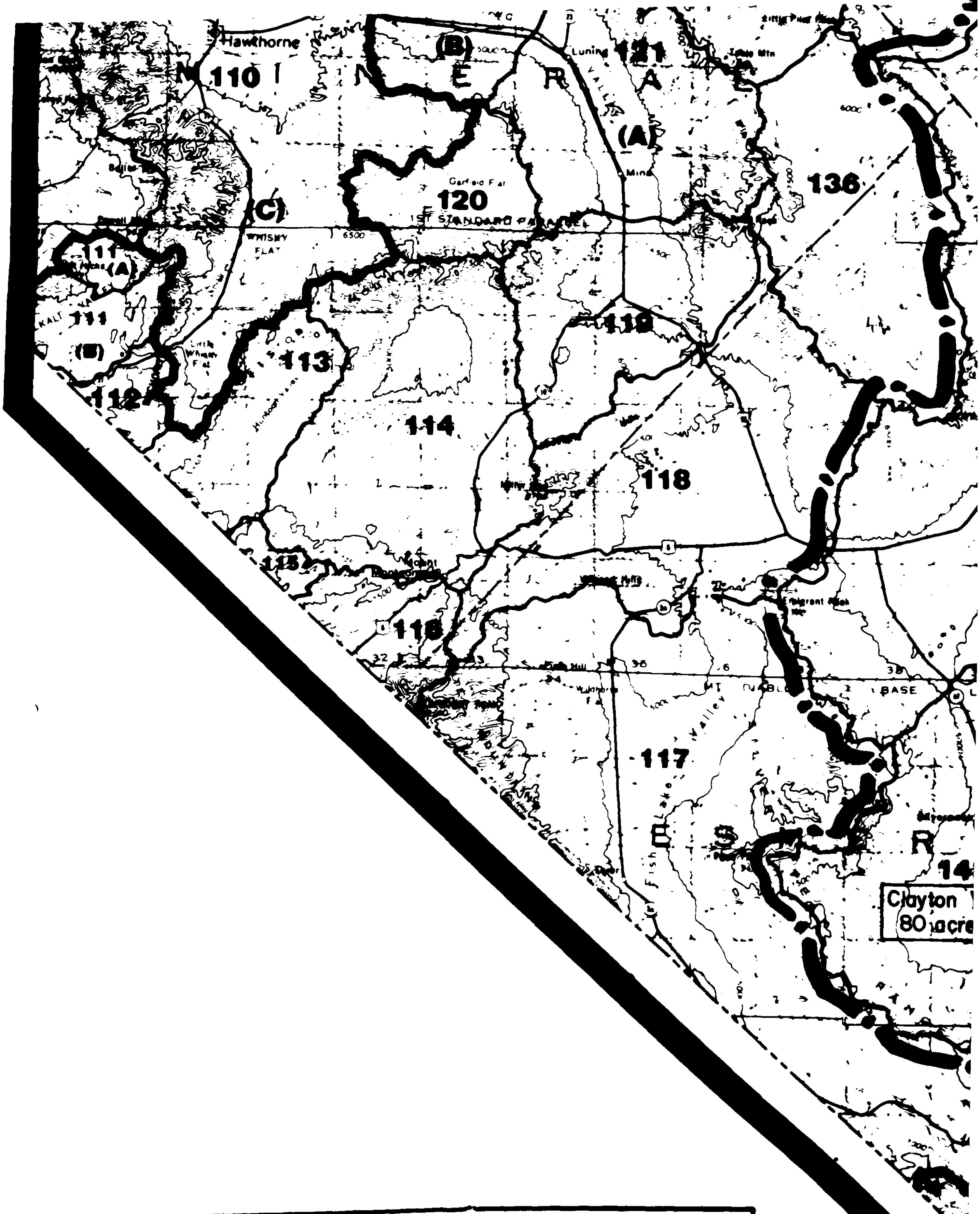
CARSON
SINK
(Alkali Flat)
128
Dixie Valley
PARALLEL
CHURCHILL
101
133
Stillwater
Fallon
EDWARDS
CREEK
VALLEY
126
127
125
124
123
STANDARD PARALLEL
(A)
ALKALI
FLAT
122
Gabbs
GABBS
110
135
(B)


138
Kobeh Valley
1800 acres
139
Steven's Basin
0 acres
Antelope Valley
500 acres
151
56
Big Smoky Valley
Northern Part
11,260 acres
137
140
(A)
(B)
Alkali Flat
Monitor Valley
Southern Part
2212 acres
Little Fish Lake Valley
240 acres
156
Round Mountain
The Point

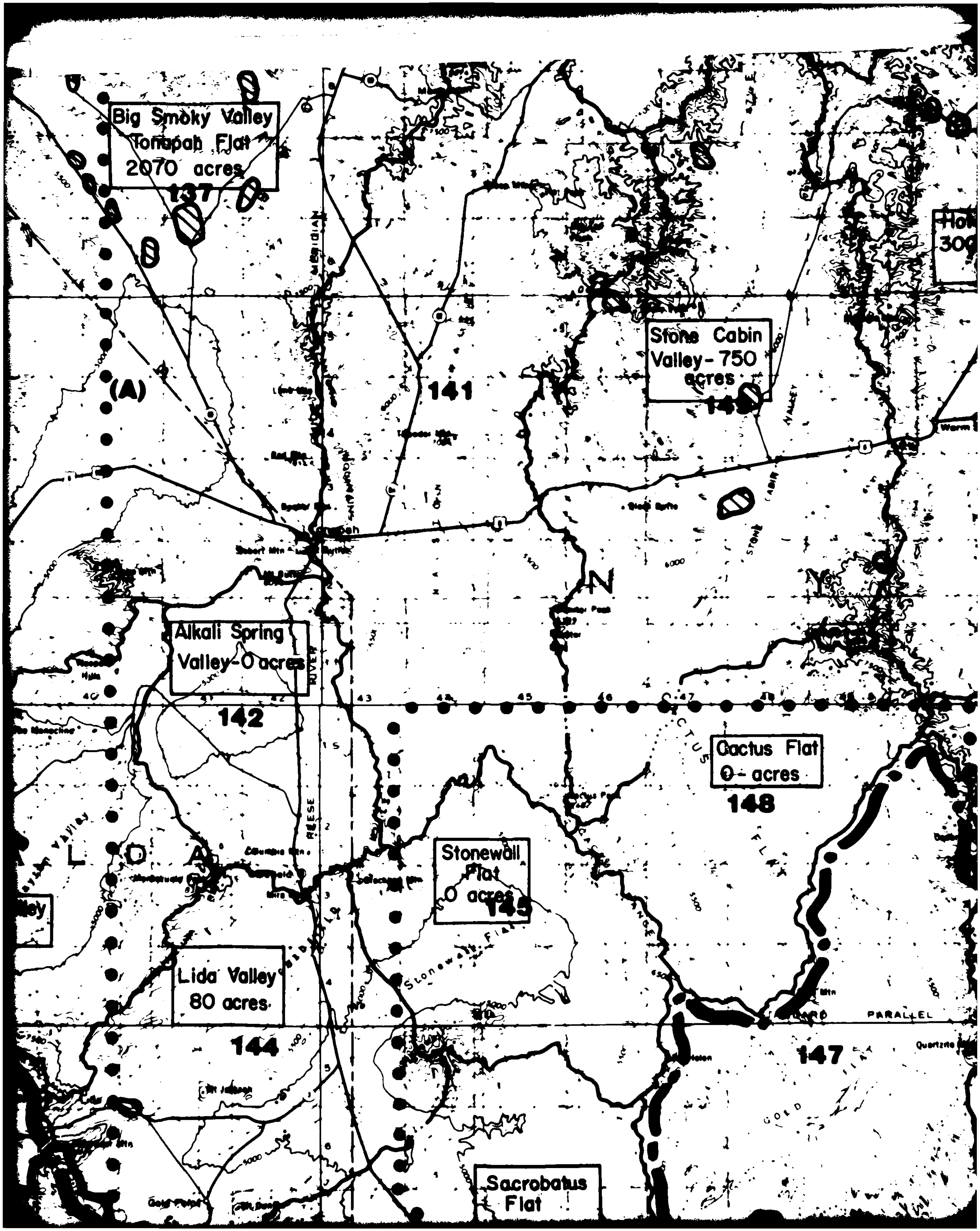


Newark Valley
4600 acres
Smoky Valley
Northern Part
1700 acres
Little Smoky
Valley
Central and
Southern parts
0 acres
Steptoe
Valley
130,000 acres
175
154
174
179
155
207
(B)
(C)
4TH STANDARD
3RD STANDARD PARALLEL
JAKES VALLEY
Ely

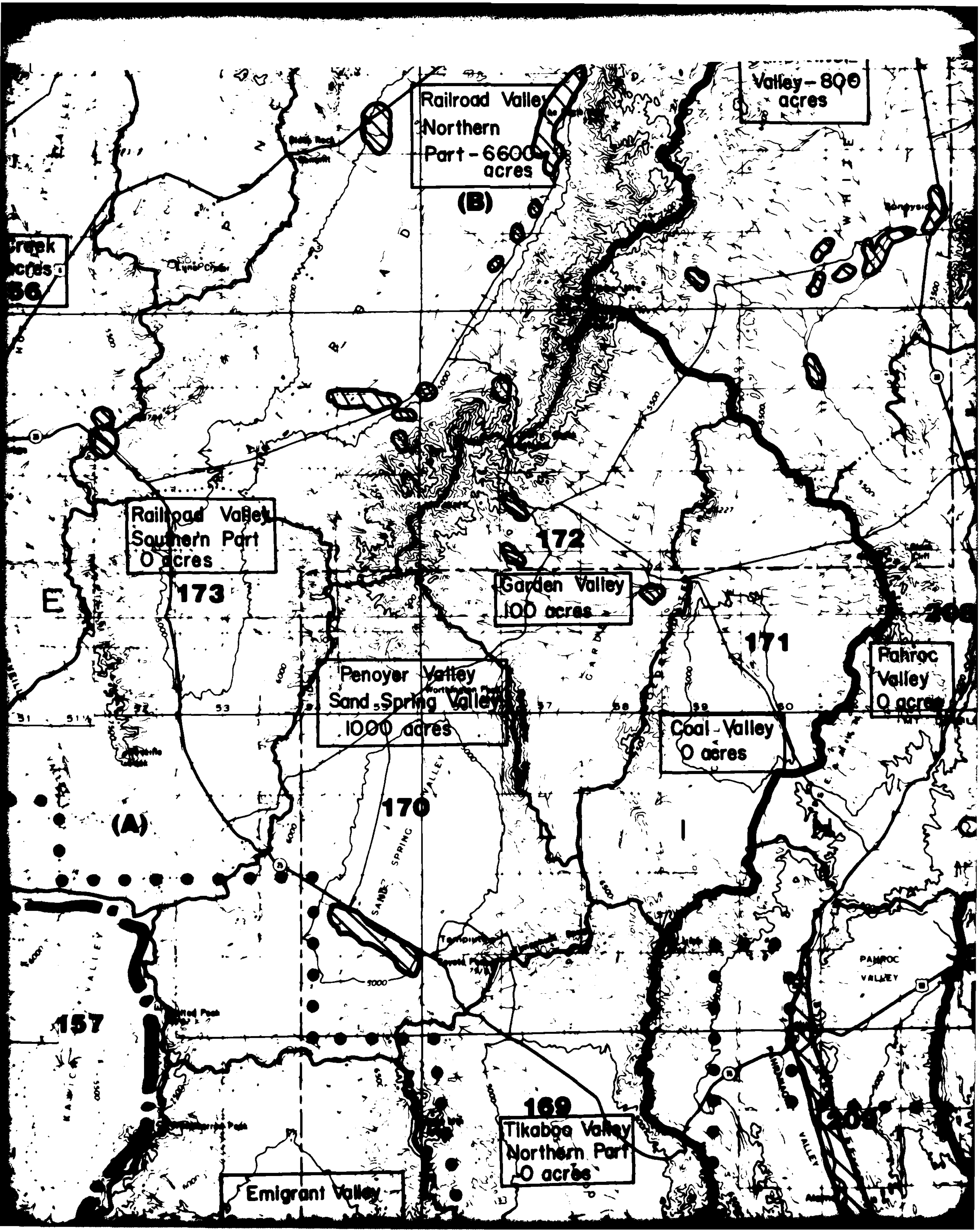

185
(B)
Pleasant Valley
Spring Valley 96,500 acres
179
Steptoe Valley 30,000 acres
207

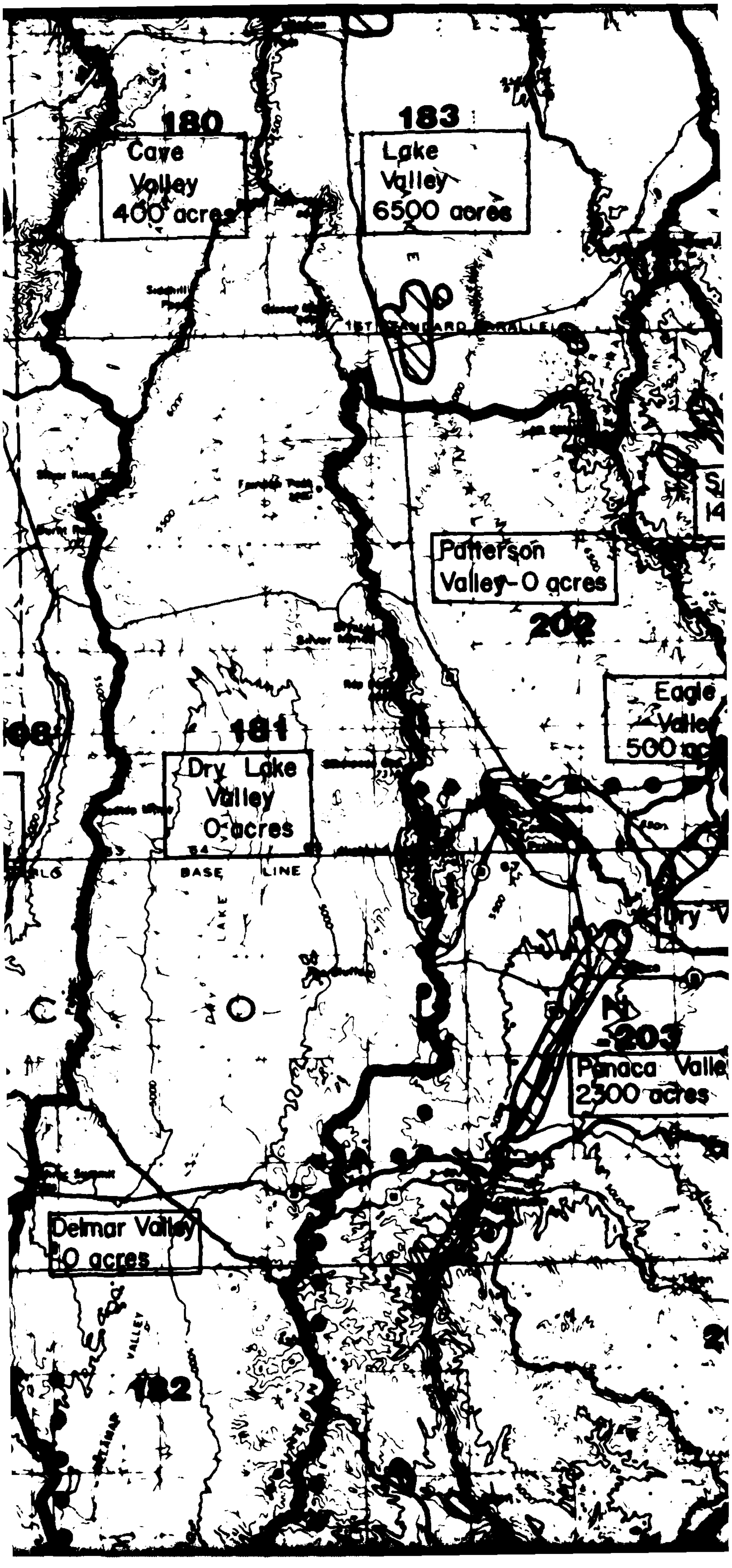


Water Resources Center



Big Smoky Valley
Tonopah Flat
2070 acres
137
(A)
141
Stone Cabin
Valley - 750
acres
Alkali Spring
Valley - 0 acres
142
Cactus Flat
0 - acres
148
Stonewall
Flat
0 acres
145
Lida Valley
80 acres
144
147
Sacrobatus
Flat
Tonopah
N
PARALLEL


Railroad Valley Northern Part - 6600 acres
Valley - 800 acres
(B)
Creek acres
Railroad Valley Southern Part 0 acres
173
172
Garden Valley 100 acres
171
Pahroc Valley 0 acres
Penoyer Valley Sand Spring Valley 1000 acres
Coal Valley 0 acres
170
(A)
E
157
169
Tikaboo Valley Northern Part 0 acres
Emigrant Valley
PAHROC VALLEY


180
Cave Valley 400 acres
183
Lake Valley 6500 acres
Patterson Valley-0 acres
202
Eagle Valley 500
181
Dry Lake Valley 0 acres
BASE LINE
203
Panaca Valley 2300 acres
Delmar Valley 0 acres
182

Water Resources Center
Desert Research Institute

PLATE 1 Inventory of Existing Irrigated Agriculture in the Proposed MX Area and Vicinity, Nevada.

LEGEND

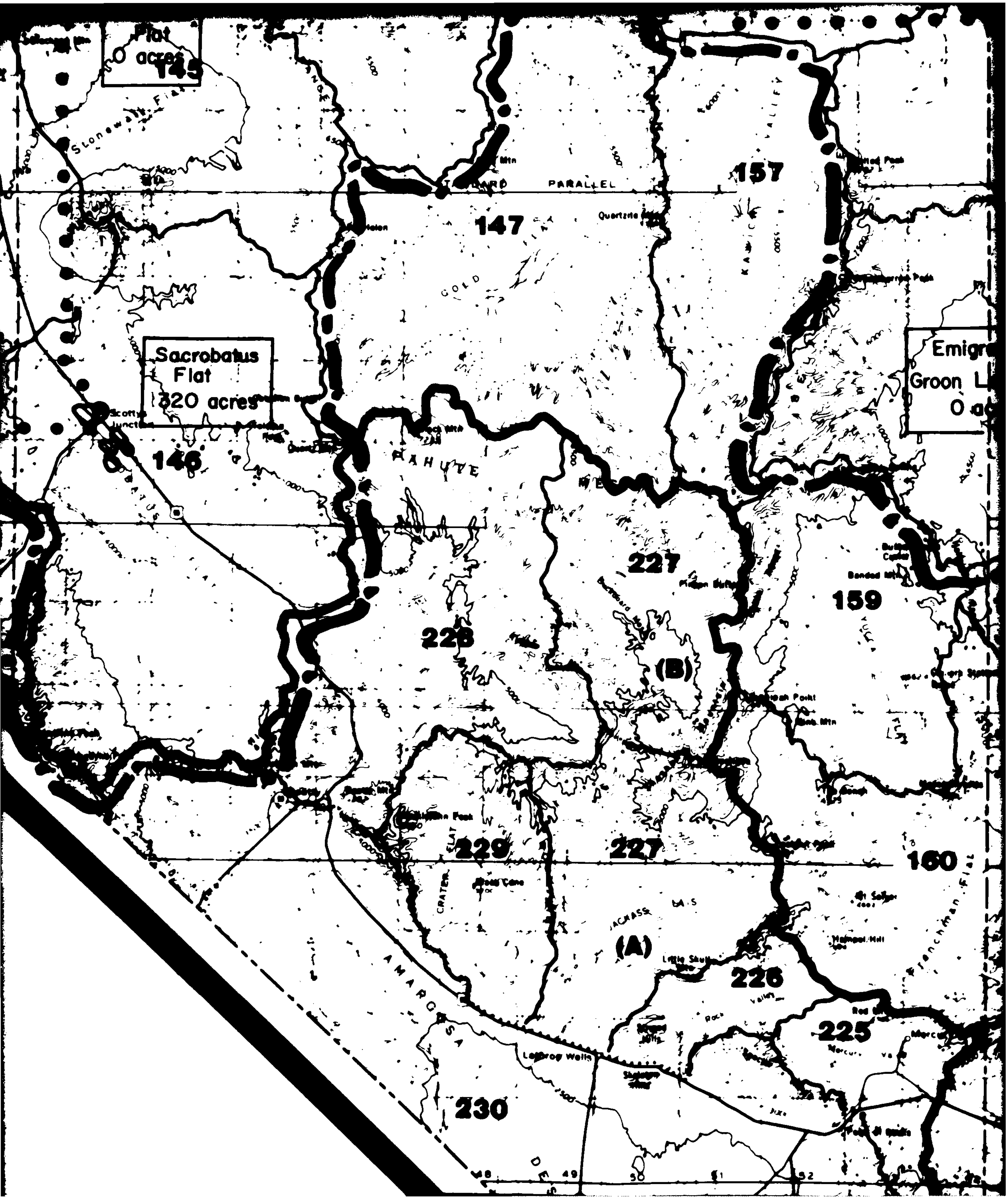
Boundary of Hydrographic Area

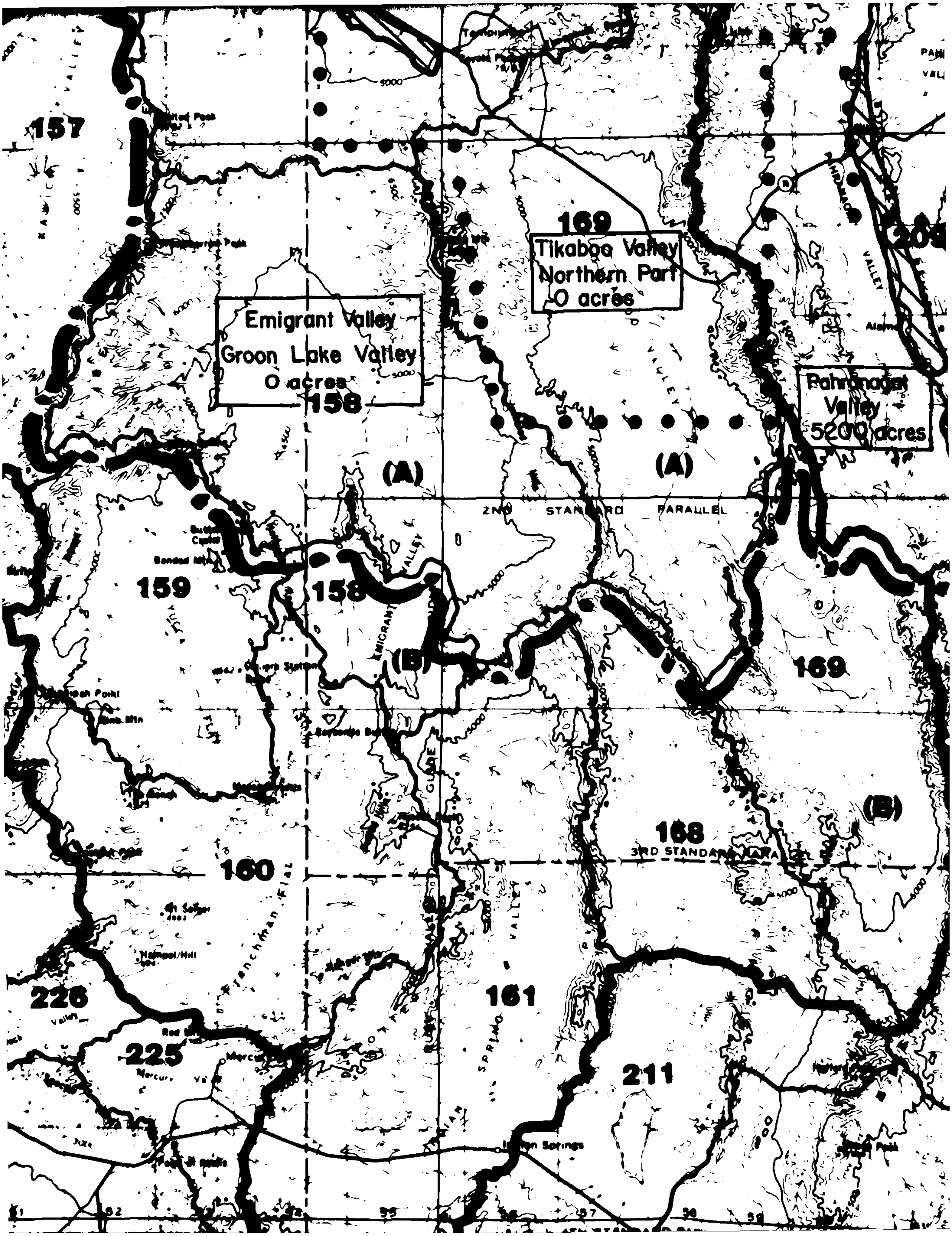
Boundary of Proposed MX Project

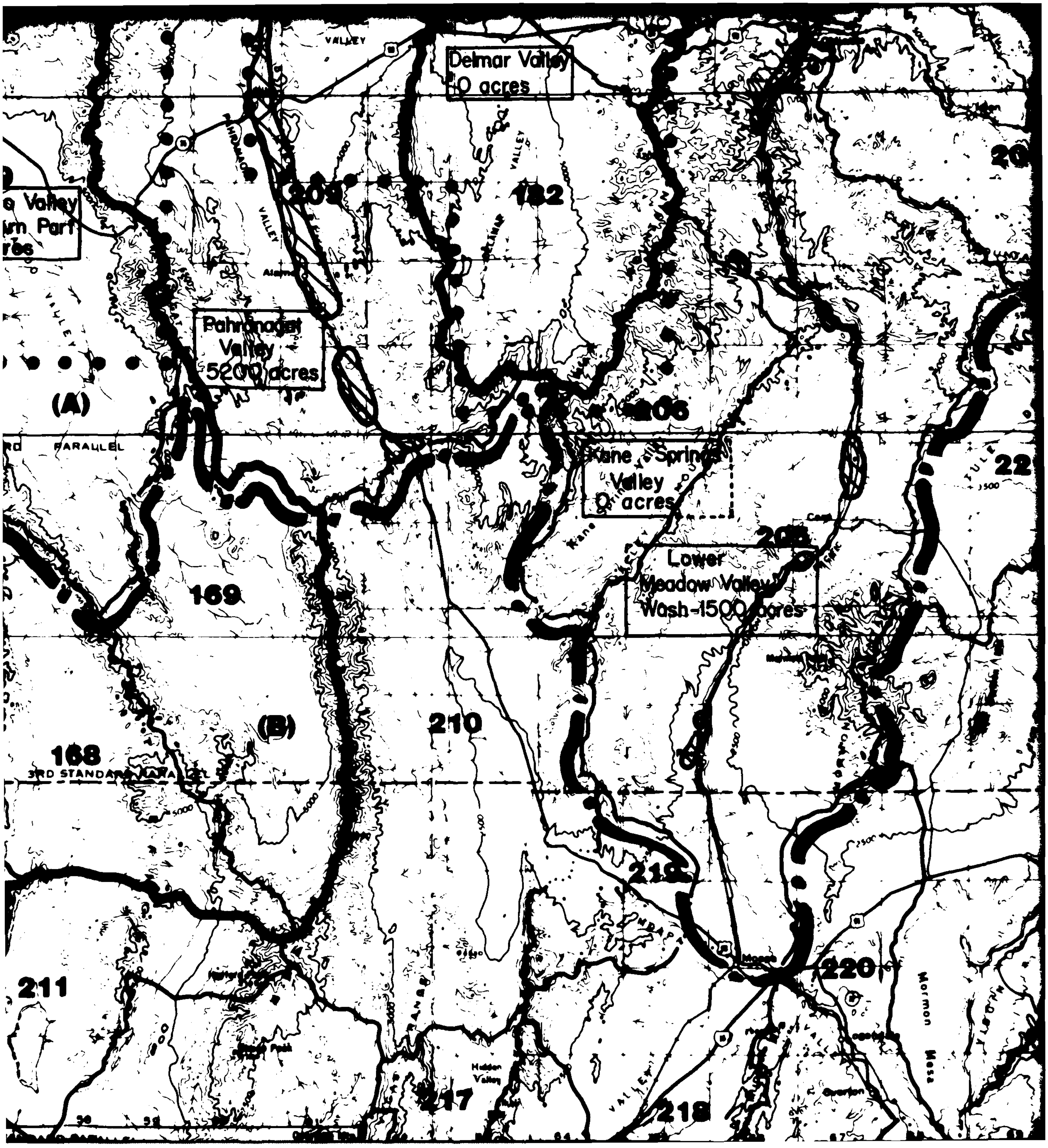
Estimated Location of Irrigated Agriculture (pumped, spring, streamflow, or combination)

Lida Valley 80 Acres	Estimated Irrigated Acres in Valleys

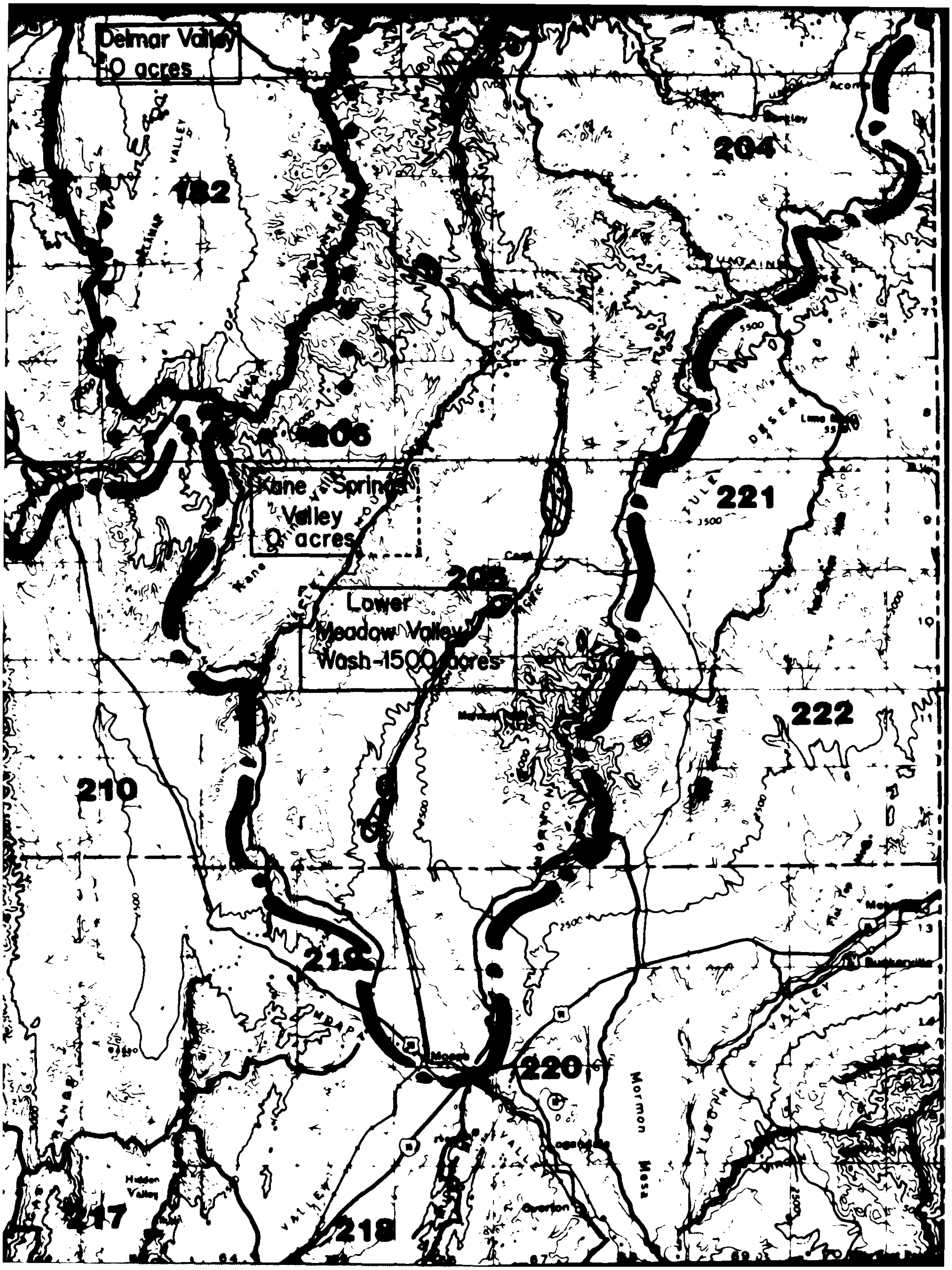
Irrigation compilation by H. Radke


Flat
0 acres
145
Sacrobatus
Flat
320 acres
146
147
157
Emigra
Groon L
0 ac
227
228
(B)
159
229
227
160
(A)
226
225
230
PARALLEL
GOLD
PAHUTE
AMARGOSA
Stonewall Flat
Quartzite Mtn
Pahute Mesa
Little Skull Mtn
Lathrop Wells
Yucca Flat
Frenchman Flat
Rock Valley
Mercury
Buried Hills
Skull Mtn
Crater Flat
Jackass Flats
Scotty's Junction
Shadow Mtn
Banded Mtn
Butte
Rainier Mesa
Pinion Butte
Sharp Point
Red Mtn
Mercury Valley


157
169
Tikaboo Valley
Northern Part
O acres
Emigrant Valley
Groon Lake Valley
O acres
158
Pahranagat
Valley
5200 acres
(A)
(A)
2ND STANDARD PARALLEL
159
158
(B)
169
(B)
168
3RD STANDARD PARALLEL
160
Frenchman Flat
226
161
225
211
Indian Springs



Delmar Valley
0 acres
Pahranagat
Valley
5200 acres
Kane Springs
Valley
0 acres
Lower
Meadow Valley
Wash-1500 acres
209
182
206
205
169
210
168
211
219
220
217
218
(A)
(B)
3RD STANDARD PARALLEL



Delmar Valley
0 acres
182
204
206
Kane Springs
Valley
0 acres
205
Lower
Meadow Valley
Wash-1500 acres
221
222
210
219
220
217
218
Mormon
Mesa
Hidden Valley
Overton

APPENDIX B

Industry Activity Inventory and Water Use
in the Area Potentially Impacted
by MX Missile Complex in Utah

INDUSTRY ACTIVITY INVENTORY AND WATER USE
IN THE AREA POTENTIALLY IMPACTED BY MX
MISSILE COMPLEX IN UTAH

by

V. A. Narasimhan, Terrence F. Glover,
Eugene K. Israelsen and L. Douglas James

Update Report

Submitted to
Fugro National, Inc.

by
Utah Water Research Laboratory
Logan, Utah

Update July, 1980

Project #WG283-1

ABSTRACT

This study inventories the water requirements for the major industries in the area associated with the Utah portion of the proposed MX Missile Project. The major industries in this region are mining, irrigated agri-culture, grazing, electric power generation, and recreation. The mining industry in particular experiences periods of boom and bust, and many mines, once active, are presently defunct. The potential exists for new mining activity as well as reviving past mining sites. These mining sites and the cooling needs of possible new coal-fired electric power plants are the chief competitors with MX for the available water, and here possibilities exist for wells being drilled for initial use in MX construction and then being converted to one of these other uses once the missile system construction is completed. Although much of the available water supply in the area is already allocated, some locations within the Snake Valley and parts of the Wah Wah and Pine Valleys are capable of sustaining additional groundwater development. The specific sites and their water yield, however, have to be assessed and approved by the State Engineer considering the existing water rights and the required trade offs between the competing water users. At other locations, water rights can be purchased from agriculture.

INTRODUCTION

The area being examined for MX missile sites includes portions of the five western Utah counties of Tooele, Juab, Millard, Beaver, and Iron as it extends from the Nevada border about 80 miles into Utah and for a north-south distance of about 200 miles as shown in Figure 1. In all five counties, irrigated agriculture and population centers are concentrated in their eastern ends where both surface and groundwater are naturally more abundant from snowmelt runoff from the high mountains that generally form the eastern boundary for the counties. The proposed missile locations are further west in the valleys between the lower desert ranges.

Because the lower desert mountain ranges accumulate less snow and runoff, nature provides less water in this desert area. Over the years, however, the surface and groundwaters to the east have been fully appropriated while unappropriated water still remains in the western desert because the water was too scarce or too costly for what was available to be developed.

Irrigated agriculture, small industry, and hydroelectric power generation activities in the five counties is almost entirely located east of the MX area. The water uses found in the proposed MX Missile area itself are largely those associated with cattle and sheep ranches, mining, recreation, and culinary use at and around a very few residences. Garrison, the largest settlement in the entire 16,000-square mile area has a population of only 60.

A substantial portion of the water resources of the area are already appropriated for ranches, mining, recreation, and homesteads. Prospective major new uses, in addition to what would be required for the MX system,

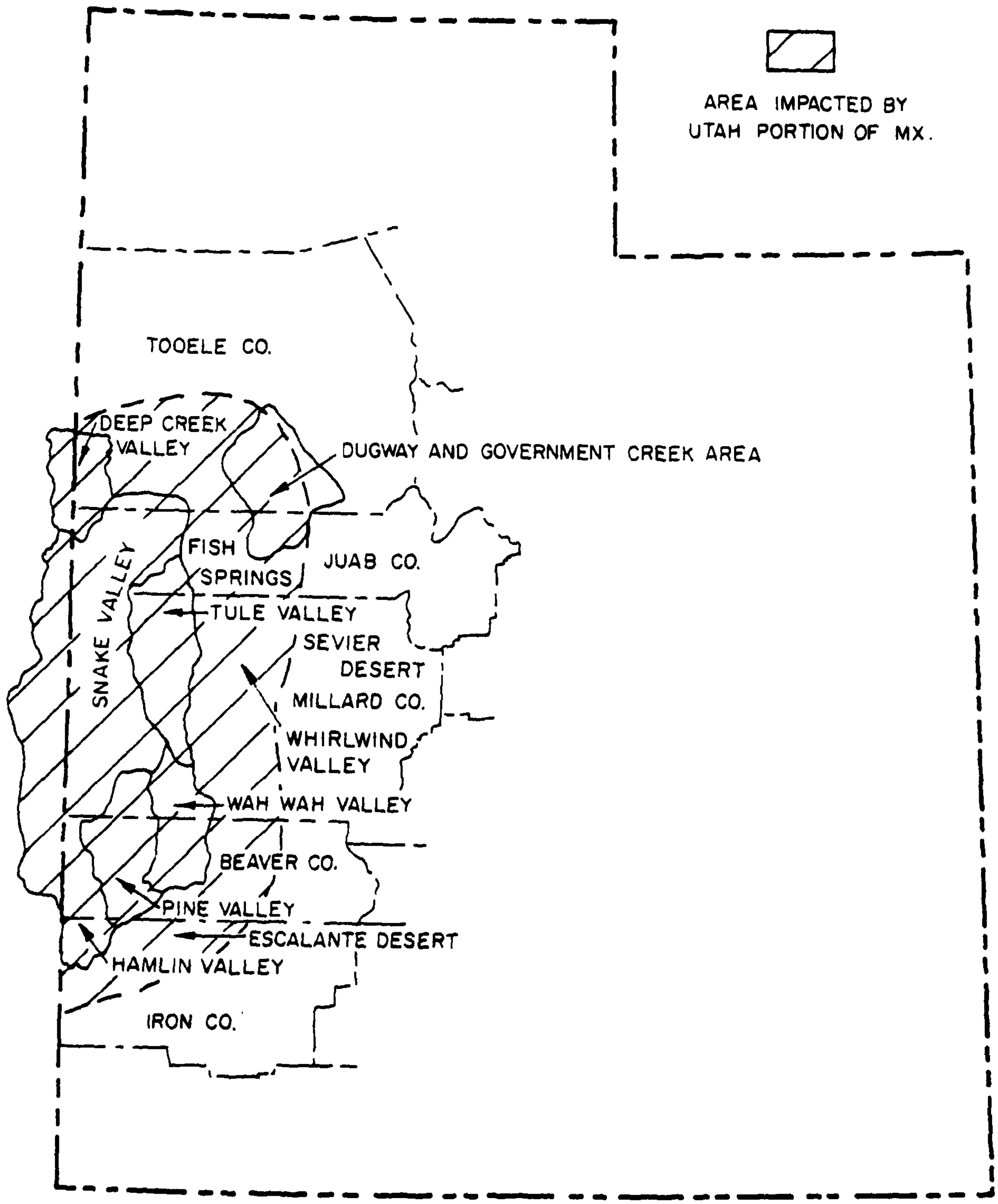


Figure 1. Map showing area impacted by Utah portion of MX Missile Complex.

include new mining activity and coal-fired, geothermal, and hydroelectric energy production.

In many areas, all ground and surface water supplies are fully committed, and no additional water development will be permitted. The proposed MX Missile complex will, therefore, have either to purchase water (some purchases could just be for temporary use during the MX construction period) from existing users or else locate in areas where unappropriated water remains. The unappropriated waters are largely groundwater in some of the more remote valleys or in the deeper aquifers, much of which is too saline for current uses.

This survey inventories water use by the existing and the proposed industries (agriculture, mining, electric power generation, and recreation) in this region to provide a basis for joint consideration of the industrial and MX Missile water needs. The results (current as of March 1980) provide basic data on water availability for planning the MX system. More generally, the results will be useful in determining which combination of management techniques (purchase of water rights or their temporary use, development of deep or remote aquifers, desalination of brines, etc.) best meets the public's needs in this desert area.

SCOPE OF WORK

The scope of work within this study included:

1. An inventory of the major existing and proposed industrial activities principally agriculture, mining, electric power generation, energy transmission, recreation etc. within the Utah portion of the proposed MX Complex area.
2. A general assessment of the present and future water requirements for the identified major water users in the region including, a) estimates of location and timing of need with respect to likely sources of supply and, b) the water quality dimension of the problem.
3. Identification of a) potential water transfer possibilities among the industries, b) other water use interactions within the region, and c) related potential conflicts over land use and environmental issues.
4. Update information reported in the April 1980 report and report the inventory on a valley basis for those valleys in the potential MX Missile area.

INDUSTRY INVENTORY

The 1980 economy of the proposed MX Missile region in Utah is based chiefly upon a) mining of metallic ores, b) irrigated agriculture, and c) livestock raising. Electric energy generation and recreation are expected to become increasingly important in the future. The project area contains about 15 commercially recoverable minerals including alunite, sulphur, uranium, clay, iron fluorspar, silver, gold, copper, and beryllium ores. Farming is limited to grains and forage crops due to the perenial water shortage and relatively short growing season. Livestock (cattle and sheep) graze in mountian pastures in the summer and in the valley areas in winter months. Potential sites for generating electricity include at leas four identified geothermal sites and five areas delineated for possible future consideration for development of coal-fired electric power plants. Inventoried herein are 1) the mineral production activity, currently in operation, active in the past, and potential prospects for the future (Figure 2), and 2) the agricultural production, electric energy generation, and recreation facilities in the region of the proposed MX Missile Complex in Utah. The water requirements for these industries are estimated in a subsequent section of this report (Table 8).

Past Mining Operations

Based on a review of pertinent literature and information obtained from several agencies and other interviews, it appeared that many mining enterprises active in the past are less active, if not defunct, at present. Mining activity is currently at a low ebb for gold, silver, copper, lead, zinc, tungsten, fluorspar, coal, uranium, and iron. Table 1 lists the major past production sites, and Figure 2 shows their approximate locations.

Table 1. Past mining operations in the proposed MX Missile region, Utah.

	Mine description	Location or valley	Active industry in the past
1	Gold Hill district	Deep Creek Valley	Gold, copper, tungsten
2	Burgin Mine near Eureka	North Tintic Valley	Lead, zinc
3	Ibapah Mining district	Deep Creek Valley	Gold, silver
4	Fish Springs (Utah International)	Fish Springs	Copper, lead, zinc
5	Dugway Mining district	Dugway Valley	Silver, lead, zinc
6	Indian Springs district	North Sevier desert	Silver, lead, zinc
7	Detroit mining district	West Sevier desert	Gold, silver, copper
8	Tungstonia Mine	Snake Valley	Tungsten
9	House range	Near Whirlwind Valley	Gold, tungsten
10	Cactus Mine	San Francisco Mountains near Wah Wah Valley	Copper
11	Horn Silver Mine	San Francisco Mountains near Wah Wah Valley	Silver, lead, zinc
12	Star district	Near Wah Wah Valley	Gold, silver, copper, lead
13	Wah Wah	Wah Wah Valley	Fluorspar, Uranium
14	Cougar Spar	near Pine Valley	Fluorspar
15	Calumet	Hamilin Valley	Silver, copper, lead
16	State line	Hamilin Valley	Gold, silver
17	Kolob Terrace	Iron-Kane Counties	Coal
18	Harmony field	Iron-Kane Counties	Coal
19	Bull Valley Cove	Near Cedar Valley	Iron
20	Desert mound	Near Cedar Valley	Iron
21	Mountain Lion	Near Cedar Valley	Iron
22	Sulphurdale	Beaver County	Sulphur

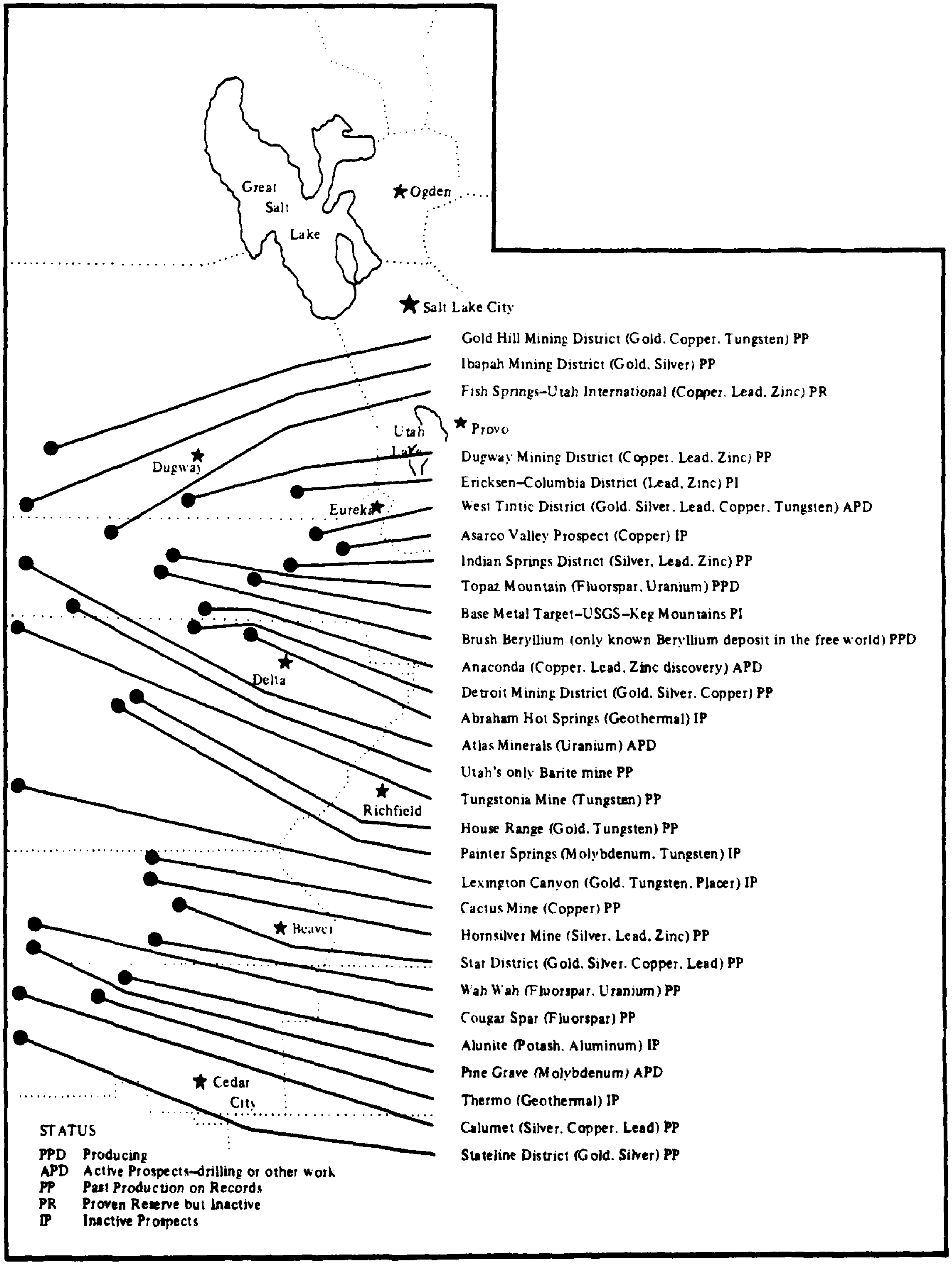


Figure 2. Mineral production and potential affected by proposed MX sites.

Increased prices for these minerals could, however, cause some of these mines to reopen. Figure 3 shows the approximate locations of the geothermal areas near the proposed MX Missile areas.

Current Industrial Activity

Mining activity

The sites of present mineral production include:

Beryllium mining: Brush Wellman Inc. commenced operation of beryllium ore processing plant near Delta in 1978. It is the only known beryllium extraction plant in the free world, and employs 103 persons.

Molybdenum: Phelps Dodge Corporation recently announced a molybdenum discovery in Beaver County near Pine Valley. Initial drilling reportedly encountered the ore at depths of 3,000 to 5,000 feet. Active mining is scheduled to start soon depending upon the complete evaluation of results of the drilling program. The planned mining operation will be by underground methods.

Iron: Currently, two major iron ore producers are operating in Iron County. CF&I Steel Corporation owns the Comstock, Duncan, and Blowout mines within the Pinto district and the McCahill-Thompson alluvial properties in the Iron Springs area. Utah Internation, Inc. operates the Black Iron, Wilson, Iron Apex, Great Western, Excelsior Group, Smith and Pittsburgh, and the Lindsay Hill mines. These mines are located in the mountains southwest of Cedar Valley.

Limestone: Explorations were completed near Leamington in the Sevier Desert for limestone and allied raw material for use in a new cement plant to be located nearby. A 400,000-ton annual capacity cement plant is envisaged and would employ about 50 people.

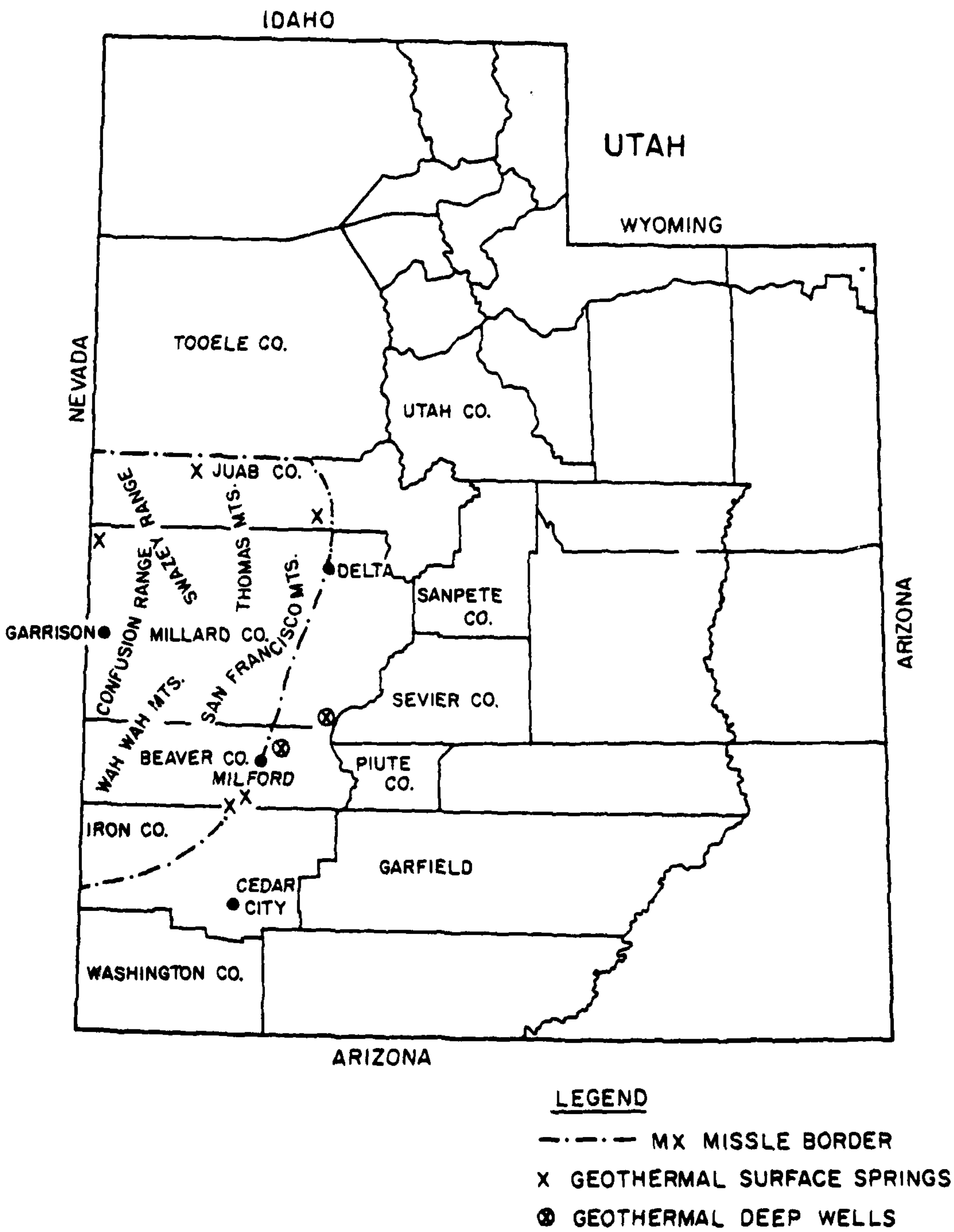


Figure 3. Geothermal spring activity within MX region, Utah.

Fluorspar and Uranium: These minerals are being extracted from the Topaz mines in Juab County near Fish Springs Flat.

Agricultural activity

Both irrigated and nonirrigated cropping and rangeland grazing are widespread. The principal crops are alfalfa (primarily for hay), wheat, oats, barley, and corn. Some potatoes and dry beans are grown and a significant alfalfa seed enterprise is located near Delta Utah. Acreage allocations of irrigated cropland in the five-county area affected by the MX Missile system were made based on information from Utah Agricultural Statistics (1979), Utah ASCS Annual Report (1977) and interviews with State and District Soil Conservation Service (SCS) personnel and state and county Agricultural Stabilization and Conservation Service (ASCS) personnel.

Detailed breakdowns of agricultural activity at the subcounty or valley level are not published. Therefore approximations of proportions had to be derived from SCS and ASCS records of feed and food grain and set aside programs and then these proportions were applied to county totals to obtain subcounty totals by crop. These totals were then aggregated into valley totals to provide a review of agricultural activity and the associated water use in the valleys that could likely be affected by the development of the MX Missile system. The allocations of acreage by crop for the valleys and other areas involved are given in Table 2.

It should be recognized that the acreages shown in Table 2 are estimates based on what available data exists in the counties involved and do not derive from exhaustive crop surveys taken by the Crop Reporting Service, SCS or ASCS agencies of the U.S. Department of Agriculture.

Table 2. Irrigated crop acreage totals in the MX Missile region, Utah.

Area	Crop Type						
	Wheat	Oats	Barley	Corn	Alfalfa	Other	Total Acreage
Southern Escalante Valley	100	40	5,800	920	14,000	2,615[a]	23,475
Cedar Valley	400	130	800	450	6,360		8,140
Hamlin Valley[b]			40		200		240
Pine Valley[b]							
Wah Wah Valley[b]							
Milford-Minersville Flats	435	1,480	740	1,330	9,765	150[c]	13,900
Beaver Valley	425	520	260	195	6,300		7,700
Snake Valley		562	1,863	200	6,200		8,825
Fish Springs Flat[b]							
Tule Valley[b]							
Whirlwind Valley[b]							
Pavant Valley	7,277	125	1,957	2,536	12,800[d]	4,500[e]	29,195
Sevier Desert	4,548	503	8,680	2,536	51,910[f]	3,200[g]	71,377
Deep Creek Valley					600		600
Dugway Valley			300		500		800
Government Creek					500		500
East Valley[b]							
Tintic Valley			280		100		380
TOTAL BY CROP	13,185	3,360	20,720	8,167	109,235	10,465	165,132

[a] 2,615 acres in potatoes
[b] Primarily rangeland and unimproved pasture land
[c] 150 acres in potatoes
[d] 650 acres in alfalfa seed production
[e] 2000 acres in irrigated pasture, 1,670 acres in potatoes, and 830 acres in dry beans
[f] 19,710 acres in alfalfa seed production
[g] 3,000 acres in irrigated pasture, 200 acres in grain sorghum

The acreage allocations by crop are also based on 1977 and 1978 data. Dry land crop acreage is not reported but significant portions of land in eastern Juab and eastern Millard Counties are in fallow reflecting the usual dryland wheat-fallow rotation that takes place in these areas. There are also areas of pastureland that are not irrigated, i.e., the so called wet meadows, that are also not reported in Table 2.

The areas for which crop acreage is allocated include the Southern Escalante (Beryl-Newcastle area) and Cedar Valleys in Iron County; Hamlin Valley in Iron and Beaver Counties; Pine Valley in Beaver County and Wah Wah Valley in Beaver and Millard Counties. The Milford-Minersville Flat area is in Beaver County as is the Beaver Valley. Snake Valley which runs through parts of western Millard and Juab Counties is included along with Fish Springs Flat, Tule Valley, Whirlwind Valley, the Sevier Desert area and Pavant Valley, also located in either Millard County or Juab County. The northern fring areas of the MX Missile area include Deep Creek Valley, Dugway Valley, Government Creek and East Valley in Tooele County and the Tintic Valley in northeastern Juab County.

The Soil Conservation Service has been actively pushing land treatment programs to increase the productivity of irrigated agriculture. The on-farm treatment measures on irrigated cropland, existing in 1965 and projected to 1980 (Table 3), are indication of the trend. An increase in sprinkler system irrigation is also apparent.

Grazing by domestic livestock is practiced extensively on public and private lands in the five county area. Most of the land is used by cattle and sheep, although hogs, poultry, and dairy enterprises are located in some areas. Utah Agricultural Statistics (1979) indicated

Table 3. Existing and projected on-farm treatment measures on irrigated cropland, Beaver River Basin, 1965 and 1980.

Conservation practice	Unit	Subbasin Fillmore	Beaver Milford	Cedar-Parowan	Escalante Desert	Total
Existing						
Field ditch reorganization	Miles	149	204	81	100	534
Land leveling	Acres	14,500	12,400	10,700	13,200	50,800
Ditch lining	Miles	49	38	28	59	174
Pipelines	Miles	13	19	5	15	52
Irrigation structures	Number	7,300	6,600	2,600	3,000	19,500
Sprinkler systems	Acres	1,100	700	600	700	3,100
Projected						
Field ditch reorganization	Miles	188	219	113	138	658
Land leveling	Acres	19,000	18,100	13,800	17,250	68,150
Ditch lining	Miles	93	123	39	80	335
Pipelines	Miles	46	30	22	42	140
Irrigation structures	Number	13,750	16,600	5,600	7,500	43,450
Sprinkler systems	Acres	4,500	3,700	3,900	4,700	16,800

Source: Water and Land Resources: Summary report, Beaver River Basin, Utah-Nevada, 1973. U.S. Department of Agriculture.

that the livestock and poultry industry of the five counties involved totalled about 287,200 animals as of the 1974 Census of Agriculture (Table 4). Current livestock estimates based on information obtained from the offices of the Bureau of Land Management in Fillmore, Cedar City and Tooele are approximately 61,900 cattle and 190,500 sheep in the Utah portion of the MX Missile region which are on farms or in a grazing rotation on federal, state and private lands. Information from county extension personnel indicates that currently there are approximately 7,100 dairy cattle in the area, 1,350 hogs and poultry numbers some 15,000. Livestock and poultry numbers have been allocated to various locations within the MX Missile area and these allocations are given in Table 4.

Energy extraction and production

Geothermal springs. There are several locations of significant geothermal spring activity within the MX area (Figure 3). The best sites are in Snake and Tule Valleys, each of which has a surface geothermal area. Two other areas are within the MX area in smaller valleys. In Snake Valley, Gandy Warm Springs consists of several large warm springs in the NW 1/4 of the NE 1/4 of section 4, T16S, R19W and which flow into Gandy Warm Creek. The temperature of these springs is 80°F with a flow of 21 cfs. In Tule Valley at the north east end of Fish Springs Mountain Range, three main groups of springs constitute the Fish Springs complex. These springs flow from 25-43 cfs at temperatures from 72-78°F and are located in T11S, R14W.

The other two thermal springs are Abraham Hot Springs and Thermo Hot Springs. Abraham Hot Springs is located 25 miles northwest of Delta, Utah, in T14S, R8W. They flow from 10-12 cfs at temperatures

Table 4. Livestock numbers in the MX Missile region, Utah.

Area	Animal Class				
	Beef Cattle[a]	Sheep[a]	Dairy Cattle[b]	Hogs[b]	Poultry[b]
Southern Escalante Valley	1,714	3,700	40		
Cedar Valley	4,385	13,933	360	100	1,000
Hamlin Valley	1,973	1,700			
Pine Valley	5,163	10,914			
Wah Wah Valley	1,696	25,022			
Milford-Minersville Flats	3,208	8,483	2,300	250	75
Beaver Valley	3,427	10,625	400		150
Snake Valley	8,511	16,935	40		200
Fish Springs Flat	1,104	8,100			
Tule Valley	2,382	11,377			
Whirlwind Valley	700	14,076			
Pavant Valley	7,956	15,031	100	100	4,000
Sevier Desert	11,545	27,241	3,900	900	9,600
Deep Creek Valley	991	6,300			
Dugway Valley		6,708			
Government Creek	964	1,320			
East Valley	750	4,622			
TOTAL BY CLASS	61,911	190,500	7,140	1,350	15,025

[a]Numbers were derived from Bureau of Land Management and Crop Reporting Service records

[b]Numbers are estimates derived from information in County extension offices and Crop Reporting Service animal numbers. Subcounty allocations are only approximate animal number divisions.

from 154-175°F. Thermo Hot Springs is located in section 21, T30S, R12W on the Beaver-Iron County border between Milford and Lund. It has a water temperature of about 164°F, but the surface flows are so small as not to be significant. Deep drilling could increase the flow. There are many other hot springs in and near the MX area that flowed in a previous era but are now dry.

The energy sources for these waters may be cooling deep lava flows or deep convection systems. The cooling of lava flows has a much shorter life span than does a deep convection system. The deep convection systems also seem to have a more stable water supply than do some of the cooling lava flow sources.

Other areas have been tested as sources of geothermal energy by drilling deep wells. The Roosevelt Hot Springs (McKeans) area is located about 9 miles north and 8 miles east of Milford. Seven wells have been drilled in the area. The water temperature is 500°F, and it is estimated that the flow would be sufficient to support a 55 megawatt generating plant. This area is about six miles east of the MX area. One other area is at Cove Fort, about 22 miles east of the MX area. The water temperature there is about 354°F, but flow estimates were not found.

Hydroelectric power

Six hydroelectric plants were operational in the Beaver River Basin in 1965. Two of the plants are owned and operated by Parowan City Corporation, two by Beaver City Corporation and the remaining two by Utah Power and Light Company. The Beaver City Corporation power plants are interconnected with Utah Power and Light system. Parowan City Corporation is interconnected with California Pacific Utilities Company and also purchses power from the Colorado River Storage Project.

The two plants of Parowan City Corporation are situated at Parowan and Paragonah. The plant at Paragonah is approximately one mile east of town and utilizes water from Red Creek. Seasonal releases from Red Creek Reservoir are supplemented by flows from springs. The plant at Parowan diverts water from Center Creek immediately below the confluence of Bowery and Parowan Creeks. The four remaining hydroelectric plants are on the Upper Beaver River system. None of these sites, however, are in the actual MX area delineated on Figure 1.

Table 5 shows the year of installation, installed capacity and 1965 energy generated at each of the six plants. Several additional hydroelectric plants were built during the early 1900s, but they were later abandoned as coal-fired power production gained the competitive advantage.

Table 5. Date of inital operation, installed capacity and 1965 power generation for hydroelectric plants, Beaver River Basin, Utah.

Plant	Year of initial operation	Installed capacity	1965 power generation
		Kilowatts	Million kilowatt-hours
Utah Power & Light Company			
Upper Beaver	1907	2,400	10.7
Lower Beaver	1919	600	3.5
Beaver City Corporation			
Beaver No. 1	1942	625	3.5
Beaver No. 2	1904	275	0.4
Parowan City Corporation			
Parowan	1907	600	3.5
Paragonah	1955	500	2.0

Source: Water and Land Resources: Summary report, Beaver River Basin, Utah-Nevada, 1973. U.S. Department of Agriculture.

Recent price increases in fossil fuels are, however, returning the competitive advantage to hydroelectricity; and the power companies are exploring old and potential new sites for future development. Utah Power and Light Company recently completed a survey of all the streams in the area looking for potential sites.

Recreation

This region contains a diversity of recreation resources. The principal developed sites and their visitor use are listed in Table 6, and their locations are shown in Figure 4. The Little Sahara, an area of sand dunes in the Sevier Desert is the most heavily used recreation site administered by the Bureau of Land Management in this region. When fully developed this site will be capable of accommodating nearly 75,000 people at one time.

The large open spaces in the region also accommodate widespread dispersed recreational activities. The principal ones are hunting for elk, deer, antelope, upland game and water fowl, sightseeing, horseback riding, camping, and picnicking.

About 25-30 percent of outdoor recreation is apparently related to fishing and hunting. Fishing is popular at reservoirs constructed primarily for irrigation water management. Water fowl and other game birds are limited but do provide some hunting opportunities.

Military facilities

Out of the three major military facilities in Utah, the Dugway Proving Grounds and Tooele Army Base are located in Tooele County. Both the facilities obtain water from groundwater sources. At a municipal withdrawal rate of 262 gcd the population equivalent would be 8100 (Hansen et al., 1979).

Table 6. Developed Recreation Stes and Their Use, Western Utah.

Site[a]		Length of Season[b]	Number of Visitors[c]	Visitor Days (12 Hours)[d]	Percent of Theoretical Capacity[e]
National Park Service					
1	Lehman Cave National Monument	365	37,392	na	na
USFS					
2	Manti Community Campground	88	na	4,100	21
3	Chicken Creek Campground	102	na	4,300	53
4	Little Valley Campground	89	na	1,400	26
5	Bear Canyon Picnic Area	153	na	10,800	40
6	Cottonwood Campground	139	na	6,100	34
7	Ponderosa Campground	153	na	16,800	39
8	Oak Creek Campground	152	na	20,300	27
9	Maple Hollow Picnicground	152	na	1,300	12
10	Maple Grove Campground	152	na	26,800	48
11	Copleys Cove Picnicground	152	na	2,100	35
12	Shingle Mill Picnicground	152	na	1,500	49
13	Buckskin Charley Picnic-ground	152	na	1,400	61
14	Pistol Rock Picnicground	152	na	5,320	30
15	Adelaid Campground	169	na	3,400	22
16	Maple Canyon Picnicground	102	na	4,000	21
17	Pinchot	102	na	5,800	30
18	Lake Hill	88	na	4,000	20
19	Spring City	88	na	1,000	23
20	City Creek	152	na	4,100	17
21	Mahogany Cove	152	na	3,100	29
22	Little Reservoir	152	na	9,000	44
23	Kents Lake	137	na	14,800	25
24	Anderson Meadow	107	na	6,200	58
25	Little Cottonwood	185	na	14,000	41
26	Castle Rock	185	na		
27	Rock Corral Campground	200	na	5,000	na
28	Paul Bunyons Woodpile Picnic Site	200	na	5,000	na
29	Simpson Springs Campround	365	na	5,000	na
30	Koosharem Campground	365	na	5,000	na
31	Little Sahara Recreation Area	365	121,299	303,072	na
32	Sand Ledges Picnic Area	365	na	5,000	na

Table 6 (continued).

Site[a]	Length of Season[b]	Number of Visitors[c]	Visitor Days (12 Hours)[d]	Percent of Theoretical Capacity[e]
State of Utah				
33 Palisade Lake State Recreation Area	184	31,910	na	130
34 Yuba Lake State Recreation Area	365	82,517	na	198
35 Minersville Reservoir Campground	365	38,444	na	na
36 Piute Reservoir	365	3,416	na	na
Millard County				
37 Gunnison Bend Reservoir County Park	365			na

Source: U.S. Department of the Interior. Bureau of Land Management. 1979. Intermountain Power Project. Vol. II. Lynndyl Alternative Site.

[a]Numbers refer to Figure 8.2-17.

[b]Number of days a year a site can be used.

[c]Indicates the number of visitors for 1976-77. Unavailable information is indicated by "na".

[d]Recreation use reported in visitor days for 1976 (a visitor day consists of 12 visitor hours which may be aggregated by one or more persons). Unavailable information is indicated by "na".

[e]Statistical sampling indicates that sites receiving use that exceeds 40 percent of capacity may show signs of deterioration, require heavy maintenance, and user experience levels diminish from overcrowding (i.e., loss of privacy and increase in disturbances). Unavailable information is indicated by "na".

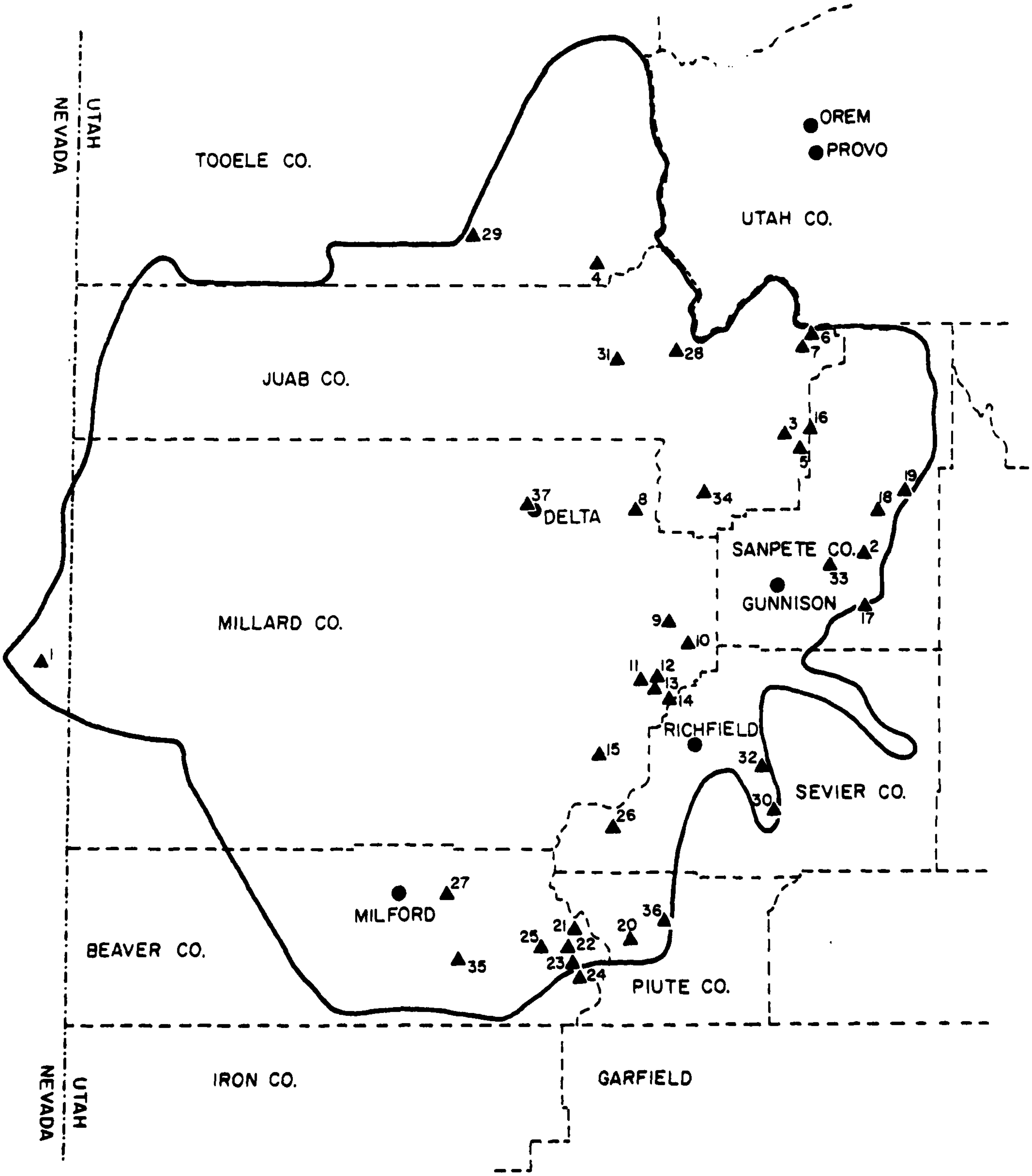


Figure 4. Developed recreation sites in the regional setting.

Possible Future Industrial Activity

A number of possibilities exist for new industry and associated increased water demands in the area. The three most likely growth industries are electric power generation, mining, and recreation.

Energy development

Preliminary studies (Glover 1978, Glover et al. 1978, Wooldridge 1979, and Keith et al. 1978) delineate five zones (Appendix A) as having potential sites for coal-fired electric power production in the area of the MX Missile complex. Two additional zones were also delineated in these studies in Eastern Juab County and in Sanpete-Sevier Counties to the east of the effected area. These zones were established primarily on the basis of air quality constraints and to some extent water constraints, although water can generally be obtained in all areas if the water right is purchased and transferred from the agricultural to the energy sector. Basic data on the possibilities for production in these five zones are included in Table 7. The estimates are rough and provide only a general order of magnitude for MX water supply planning, since power plants are not actually planned for the areas with the exception of the Intermountain Power Project in the Sevier Desert.

Energy transportation

Electric transmission lines, coal slurry pipelines, and railroad transportation of coal are anticipated if the proposed coal-fired electric generating plants materialize. The general corridors through which the transmission lines would pass are Fish Springs Flat, Delta West, Milford-Black Rock and West, Lund-Beryl and Northwest, and Eastern Snake Valley (Appendix B).

Table 7. Potential electric power generation and associated water requirements in the MX Missile region, Utah.

Zone		Area	Power Potential	Water requirements	Remarks
			Megawatts (MWe)	Acft/year	
Zone 1:	Central-West Central Iron County	Beryl area (Escalante Valley)	1,500	22,040	Groundwater supplies in this area are fairly large, but quality is unknown.
		Near Cedar City (Cedar Valley)	500		
		Total	2,000		
Zone 2:	Milford-Blackrock area	Blackrock	3,000	66,120	Production is limited to 2600 MWe with gate prices of $30/MWh, and the corresponding water requirement would be 28,650 acre-feet/year.
		Minersville (Both in Milford-Minersville Flats)	3,000	78,000	
		Total	6,000		
Zone 3:	Northeast Millard County	IPP (Sevier Desert)	3,000	33,000	Water rights from local canal companies are being negotiated.
		Soap Wash (Sevier Desert) or McCornik-Greenwood area (Pavant Valley)	5,600	100,000 to 130,000	With a gate price of $30/MWh, production is limited to just 400 MWe over the proposed IPP level, and the water requirement would be 37,470 acre-feet/year.
		Total	8,600		
Zone 6:	Western Juab County	Fsh Springs Flat	2,800	30,850	Water would have to come from groundwater sources, the yield of which is not known.
Zone 7:	Snake Valley	Snake Valley	2,500	27,550	Water would have to come from groundwater sources, the yield of which is not known.

Mining activity

Potential mineral production sites identified by the Utah Mining Association include the West Tintic district (gold, silver, copper, and tungsten), Atlas Minerals (uranium) and Anaconda (copper, lead, zinc) in Juab County; and Pine Grove (molybdenum) in Beaver County.

A 500 ton per day quick lime plant is being built south of Delta in Millard County by Steel Brothers Canada Ltd. of Vancouver, B.C. This plant will produce quick lime principally for use in flue gas scrubbers at power plants and other industrial plants. Limestone for the plant would be mined by open pit from a deposit 6 miles to the west in the Cricket Mountains. The firm would initially employ 28 workers at the mine and lime plant.

Recreation

Because of low population density and significant amounts of federal land, most of the region is available for dispersed recreational use. The proximity of the region to national parks and monuments, outstanding scenic and geologic vistas, significant historical and archeological sites, and major transportation arteries combine to provide considerable potential for developments and enhancement. Potential recreational developments include big game and fish habitat improvement, and outdoor recreational facilites. Some areas have been in the wilderness inventory being developed by the Bureau of Land Management. Most of these areas are not in the valleys which would be affected by the MX Missile complex but they are near in the mountains such as the Deep Creek Range, Swazey Peak, King Top and Notch Peak. The status of these areas is still to be determined from the information developed by the Bureau of Land Management and then congressional action. The recent approval of the Intermountain

Power Project was completed in past by the withdrawal of certain areas from further wilderness study. However, discussion and study of the Deep Creek Range is still going on.

INDUSTRIAL WATER REQUIREMENTS

Water use varies with the type of industry, the season of the year, climatic conditions, and the amount of water actually available. While farming and grazing operations use water from both surface and underground sources, the water for mining activity is primarily groundwater from local aquifers. Transportation of water through pipelines for mining purposes and ponding water in small stock water reservoirs for grazing purposes are also prevalent.

Table 8 summarizes the results of an assessment of the industrial water use in the MX region based on 1) historic and projected industrial water use estimates in Hansen et al.(1979), 2) consumptive use estimates for crops by Huber et al.(1980), and 3) information obtained from some mining companies. Agricultural enterprise and associated water use data were obtained from Agricultural Stabilization and Conservation Service, Soil Conservation Service, and Utah Crop and Livestock Reporting Service Personnel.

The estimated groundwater withdrawals in 1978 in different valleys of the MX region, based on Don Price and others (1979) are shown in Table 9. The 1978 withdrawals were less than those in 1977 on account of above average precipitation and more surface water available for irrigation, whereas, 1977 was a drought year in which nearly all the water used had to be pumped.

Table 8. Industrial water requirements in the MX region of Utah by area.

Industry	Base year of estimate	Quantity produced	Water Requirements: Water use	Water Requirements: Number of employees	Water Requirements: Water Use per Employee		Total Water Use (acre feet/year): Estimated	Total Water Use (acre feet/year): Appropriated
Southern Escalante Valley								
Crops	1977-1978	23,475 acres	3.5 acre-feet per acre				82,163	
Livestock	1979	5,454 head	a/				21	
Coal-fired electric power	future potential	1,500 MWe					16,530	
						TOTAL	98,714	
Cedar Valley								
Crops	1977-1978	8,140 acres per acre	3.5 acre feet				28,490	
Livestock	1979	19,778 head	a/				67	
Coal-fired electric power	future potential	500 MWe					5,510	
Iron	1978	2,040,000 tons/year		180			18	
Manufacturing	1979						372	
						Total	34,457	

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water use	Number of employees	Water Use per Employee	Total Water Use (acre feet/year) Estimated	Appropriated
			Water Requirements				
			Hamlin Valley				
Crops	1977-1978	240 acres	3.5 acre feet per acre			840	
Livestock	1979	3,673 head	a/			18	
					TOTAL	858	
			Pine Valley				
Livestock	1979	16,077 head	a/			47	
Molybdenum	future potential					6,000 - 10,000[b]	
					TOTAL	6,047 - 10,047	
			Wah Wah Valley				
Livestock	1979	26,718 head	a/			52	
Alunite ore[c]	future potential	4,000,000 tons/year		100		32	
Alumina[d]	future potential	500,000 tons/year		900		8,180	
					TOTAL	8,264	

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water Requirements: Water use	Number of employees	Water Use per Employee	Total Water Use (acre feet/year): Estimated	Appropriated
Milford-Minersville Flats							
Crops	1978-1979	13,900 acres	3 acre feet per acre			48,650	
Livestock	1979	14,316 head	a/			77	
Coal-fired electric power	future potential	2,600 MWe				28,650	
Geothermal energy	future potential	50 MWe				118	
Manufactu ing	1979					67	
Recreation	1976	38,444 visitors/year	50-100 gals/visitor			9	
					TOTAL	77,571	
Beaver Valley							
Crops	1977-1978	7,700 acres	3.5 acre feet per acre			26,950	
Livestock	1979	14,602 head	a/			53	
Hatchery	1979					5,841	
Manufacturing	1979					75	
Recreation	1976	18,000 approx. visitors	50-100 gals/visitor			4	
					TOTAL	32,923	

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water Requirements: Water use	Number of employees	Water Use per Employee		Total Water Use (acre feet/year): Estimated	Appropriated
Snake Valley								
Crops	1977-1978	8,825 acres	3.5 acre feet				30,888	
Livestock	1979	25,686	a/				74	
Coal-fired electric power	future potential	2,500 MWe					27,550	
Uranium	future potential	drilling exploratng					e	
						TOTAL	58,512	
Fish Springs Flat								
Livestock	1979	9,204 head	a/				20	
Coal-fired electric power	future potential	2,800 MWe					30,850	
Uranium	future	5-8 tons/year	0.184 mg/ton				4	
						TOTAL	30,874	
Tule Valley								
Livestock	1979	13,759 head	a/				33	
						TOTAL	33	
Whirlwind Valley								
Livestock	1979	14,776 head	a/				28	
						TOTAL	28	

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water use	Number of employees	Water Use per Employee		Total Water Use (acre feet/year) Estimated	Appropriated
				Pavant Valley				
Crops	1977-1978	29,195 acres	3.5 acre feet				102,182	
Livestock	1979	27,187 head	a/				96	
Coal-fired electric power	future potential	5,600 MWe					61,700	
Manufacturing	1979						264	
Recreation	1976	2,720 approx. visitors					1	
						TOTAL	164,243	
				Sevier Desert				
Crops	1977-1978	71,377 acres	3.5 acre feet				249,820	
Livestock	1979	53,186 head	a/				208	
Beryllium	1978	5-8 tons/year						1,547
Cement	1979	400,000		50	3,500 ged			500
Coal-fired electric power	future potential	3,000 MWe					33,000	
Manufacturing	1979						101	
Quick Lime	1980	500 tons/day		28	3,500 ged		110	
Recreation	1976	approx. 132,330 visitors/year					31	
						Total	283,270	2,047

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water use	Number of employees	Water Use per Employee		Total Water Use (acre feet/year) Estimated	Appropriated
				Water Requirements				
				Deep Creek Valley				
Crops	1977-1978	600 acres	3.5 acre feet				2,800	
Livestock	1979	7,291 head	a/				21	
						Total	2,821	
				Dugway Valley				
Crops	1977-1978	800 acres	3.5 acre feet				3,800	
Livestock	1979	6,708 head	a/				11	
Military facilities	average year						2,375	
						Total	6,186	
				Government Creek				
Crops	1977-1978	500 acres	3.5 acre feet				1,750	
Livestock	1979	2,248 head	a/				7	
Recreation	1976	approx. 2000 visitors/year					1	
						Total	1,758	
				East Valley				
Livestock	1979	5,372 head	a/				12	
						Total	12	

Table 8. Continued

Industry	Base year of estimate	Quantity produced	Water Requirements: Water use	Water Requirements: Number of employees	Water Requirements: Water Use per Employee	Total Water Use (acre feet/year): Estimated	Total Water Use (acre feet/year): Appropriated
Tintic Valley							
Crops	1977-1978	380 acres	3.5 acre feet			1,330	
Livestock	1979	9,855 head	a/			39	
Cinder-Clay	1978	30,000 tons/year				2	
Recreation	1976	approx. 2,000 visitors/year				1	
Silver-Gold tungsten	future potential					10[b]	
					TOTAL	1,382	

a/ Water requirements for animals are: cattle (summer grazing) 10 gcd; cattle (winter grazing) 7 gcd; sheep (summer grazing) 8 gcd; sheep (winter grazing) 3 gcd; dairy cattle 13 gcd; hogs 6 gcd; poultry 500 gpd/2000 head.

b/ Gross estimate given very preliminary estimates of maximum potential output of molybdenum in the area.

c/ Projected mining of alunite ore for Alunite Project.

d/ Projected alumina tonnage is given but other products were included in the production plans such as potassium sulfate, phosphate fertilizers and aluminum flouride. Water use projected is for total production of all products.

e/ Future water use is unknown.

Table 9. Groundwater withdrawals in 1978 in MX Region (Don Price, 1979).

Area	Estimated withdrawals from wells 1978 (acre-feet)					
	Irrigation	Industry	Public Supply	Domestic and Stock	Total (Rounded)	1968-77 average annual
Sevier Desert	35,700	2,000	600	900	39,000	38,000
Cedar Valley	27,600	1,000	2,100	300	31,000	33,000
Parowan Valley	28,400	250	350	150	29,000	27,000
Escalante Valley						
Milford area	57,000	0	1,000	300	58,000	59,000
Beryl-Enterprise area	90,000	3,300	18,500	1,200	113,000	83,000

*Refer to Figure A-2 in Appendix for the location of the valleys.

HYDROLOGIC DATA

Jeppson et al. (1968) prepared a detailed hydrologic atlas mapping precipitation, temperature, evapotranspiration, and surface and groundwater quality and quantity information for all of Utah. These maps show that in the western desert area where the MX missile system is proposed th t water is scarce and that what is available originates in the local areas in a few scattered mountain ranges.

The precipitation in the valleys is usually less than eight inches except in Escalante Valley where precipitation reaches 10 inches. The small mountain ranges receive from 16 to 20 inches except for the Deep Creek Mountains in the northwest corner of Juab County where average annual precipitation amounts reach 30 inches. Evapotranspiration estimates are from less than 18 inches at the higher elevations in the small mountain ranges to between 27 and 30 inches in the Sevier and Black Rock Deserts, in Tule Valley, and in the lower portion of Snake Valley.

The potential evapotranspiration far exceeds precipitation everywhere except for a few very limited areas at higher elevations. The average annual surface water yield in the valleys is less than one inch. In the small mountain ranges, yields range up to just over 2 inches except for amounts up to 12 inches in the Deep Creek Mountains. Surface flows coming out of these ranges generally completely infiltrate within a few miles of leaving the mountains. The flows in upper Snake Valley and the flow above Pruess Lake are about 7,000 and 8,000 acre feet annually. Overall in this dry desert climate, there is only minimal surface water yield in the proposed MX missile system area. The areas of potential groundwater development are shown in other sections of the report.

WATER USE INTERACTIONS

Some groundwater is available for appropriation in the remote western valleys (precise estimates of unappropriated water amounts by valley have not been made) and from the deeper aquifers (the Navajo Sandstone is best known), and present competition for these supplies is minimal. Future competition will be greatest in those valleys near where one of the large coal-fired power generating plants described in Table 7 ends up being located, if at all. Currently, the only planned power generating complex is at the site west of Lynndyl in the Sevier Desert. The other zones have only been delineated as areas having some potential for further study of the possibility of locating power plants within the zones.

Some possibilities for competition with mining needs also exist but would be less intense, except for in the Pine and Wah Wah Valleys should molybdenum and alunite production complexes start up in the near future in these areas. A 6,000-10,000 acre feet withdrawal in the Pine Valley or Wah Wah Valley is certainly great relative to what is little known about the availability of water in these areas. The business consortium which originally developed the plans for producing alumina in Wah Wah Valley has broken up and currently there are no plans for advancing to the mining and construction phase although a draft environmental impact statement (U.S. Bureau of Land Management, 1976) has been prepared. There is also a potential for molybdenum production but development plans have not significantly advanced. There has been some preliminary plans for the development of a hybrid cycle geothermal-coal-fired electricity generating complex at Roosevelt Hot Springs (City of Burbank, 1977) as well as the geothermal cycle unit which would withdraw considerable

amounts of water from sources in that area if actually built and operated. There have also been some discussions about the location of a 400-800 MWe coal-fired power plant in the southern Escalante Valley but no actual proposals have come forth. It appears that the criterion of water availability would suggest locating MX facilities in the desert valleys further to the west in Utah's western desert areas, i.e., in western Millard, Beaver and Juab Counties. However, should rather large mining complexes move from the preliminary to advance planning stages, then water uses would have to be more carefully coordinated because two major uses could probably not be accomodated simultaneously in valleys such as the Pine and Wah Wah valleys. There is also the livestock and crop usage to consider in the western valleys also.

If the MX facilities were to be installed in one of the zones where serious consideration for power plant siting, the development would probably have to occur in series. If MX Missile site construction peaks in 1987, the date currently being used for planning purposes, the power plant construction would occur afterwords and thus at a time when the water would no longer be needed for concrete mixing. A good possibility thus exists for initially drilling the needed wells for water use in MX construction and then converting them later to supply for water power plant cooling. There would be competition for the developed water source between power generation and an operations base however. Other possibilities exist for converting water developed for MX Missile site construction to later use for mining, agriculture, or recreation.

In many of these desert valleys, groundwater development means mining water used now and thereby made unavailable for the future. The issues which sould be considered in deciding whether or not mining water

for MX construction and operation use is justified are many and varied and beyond the scope of this report to analyze.

At locations where the available water is already fully appropriated, Utah water law permits water rights to be purchased (and later sold should they no longer be needed at the conclusion of the construction phase of the MX project) in the open water market (Gardner and Fullerton, 1968, Anderson, 1975). Presently, the surface rights to the Sevier system are completely allocated, and withdrawals exceed recharge in the Cedar-Beaver hydrological subbasin.

Some rather significant interactions among water users may present themselves with the introduction of the large scale Intermountain Power Project (IPP) at Lynndyl and simultaneous construction of the MX Missile complex. The purchase of agricultural water for the IPP complex is being negotiated and is apparently the least costly source of water. Purchase would also appear to be the cheapest alternative for any MX Missile needs near Delta. However, the Utah State Engineer, acting under authority given to protect existing water rights to the Sevier system, is only allowing 2.5 acre-feet of each approximately 4 acre-feet allotment per acre to be transferred in the Lower Sevier. This results from his finding that the remaining 1.5 acre-feet of applied irrigation water generally flows downstream for other users or percolates back to the water table. This same rule would apply to purchase of water for MX use were the MX use judged entirely consumptive.

The State Engineer can be expected to follow this same principle in other subbasins in western Utah. This policy limits the transfer of water from agriculture to large defense systems, mining operations, or electric power generation. Water right transfers would diminish the

agricultural base in the Milford or Delta areas even within these transfer limits (Keith, et al., 1978 and Glover and Keith, 1979). Acreage with marginal agricultural productivity in both areas would be removed from production. The main water tradeoffs are among energy development, the MX Missle complex, and the agricultural base of the area.

APPENDIX A

POTENTIAL ELECTRIC POWER GENERATION AND WATER USE IN UTAH'S GREAT BASIN

Potential Zones for Power Generation

In the past two years there has been considerable evaluation of the possibility of increasing the production of electric power in Utah. The increased production is projected to materialize in the form of coal-fired electric power generation, and, although the coal resorces to fuel this projected generation capacity are located in the Colorado Plateau area of Utah and Colorado and other areas in Wyoming, the Great Basin is being viewed as a potential generation location. The valleys of the basin provide some advantage with respect to air dispersion and distance from delicate environments in minimizing environmental alteration in the state as power production growth takes place. Several air dispersion modeling efforts have concluded that favorable air quality conditions exist in several areas of Western Utah outside the nonattainment area of the Wasatch Front.

In the past two years a team of scientists at Utah State University has been evaluating the environmental and economic advantages and disadvantages of siting energy facilities in Utah's Great Basin (Glover 1978, Glover, et al., 1978, Wooldridge, 1979, and Keith et al. 1978). Detailed environmental and economic evaluations have been made of various areas of Western Utah and some potential zones for electric power production have been delineated. This delineation has by no means, designated certain sites for siting power production facilities, but rather provides information on the potential and/or disadvantages of various zones. The zones that have been delineated which are near or in the MX Missile site areas include:

1. Central-West Central, Iron County (lower Escalante Valley).
2. The Milford-Black Rock area of Beaver and Millard Counties (including the area of the Roosevelt Springs geothermal area).
3. Sanpete-Sevier Counties.
4. Eastern Juab County (Dog Valley).
5. Northeast Millard County (Sevier Desert).
6. Western Juab County in the Fish Springs Flat area.
7. Southeast Snake Valley near the Nevada border.

These zones are delineated in Figure A-1. Five of the nine zones are in the genral area of the proposed MX missile complex. The zones are mainly located in valleys where air dispersion is favorable for mixing the large volumes of sulfur and particulate emissions that potentially could come from coal-fired generating plant sources even with mandated sulfur dioxide and particulate air pollution control systems incorporated. They are also close to known and developed water sources, both surface and underground. Figure A-2 shows these known and developed water sources in Western Utah.

Potential Power Production and Projected Water Use

Based on environmental considerations, electric power production limits have been outlined for the nine zones delineated in the Utah Consortium for Energy Research and Education (UCERE) evaluations (Wooldridge, 1979). These are reviewed for the five zones which are also located in the proposed MX missile sites in Juab, Millard, Beaver and Iron Counties. The production limits were primarily derived from air quality constraints (air dispersion modeling of constraints) and to some extent water constraints although for the levels involved water is available if the use right is transferred from the agricultural to the energy sector.

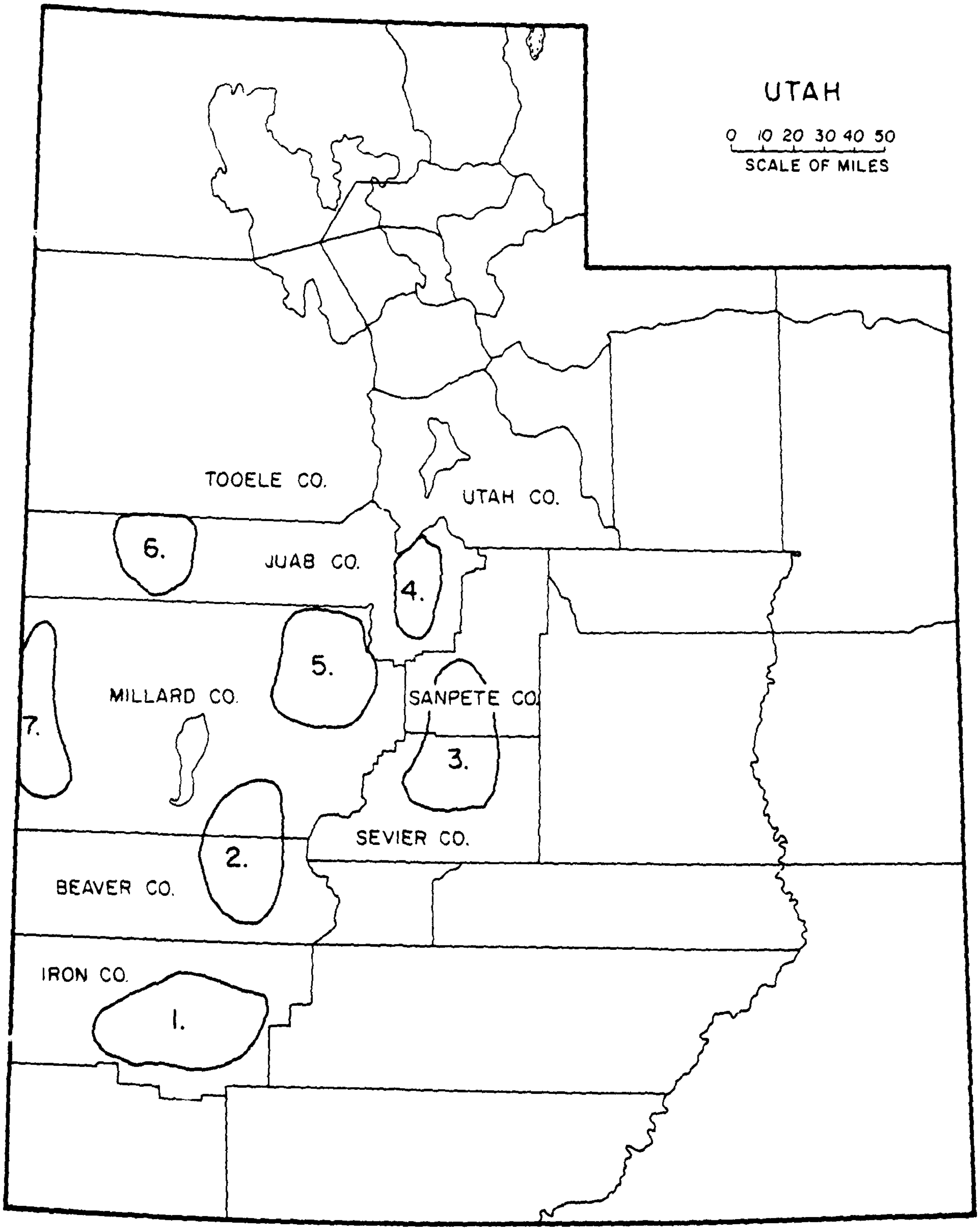


Figure A-1. Identified potential power plant siting zones in the Great Basin Area of Utah.

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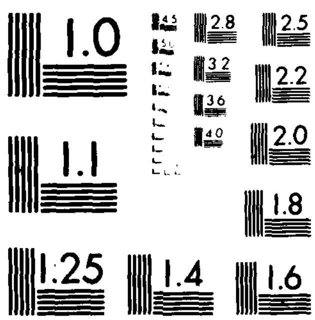

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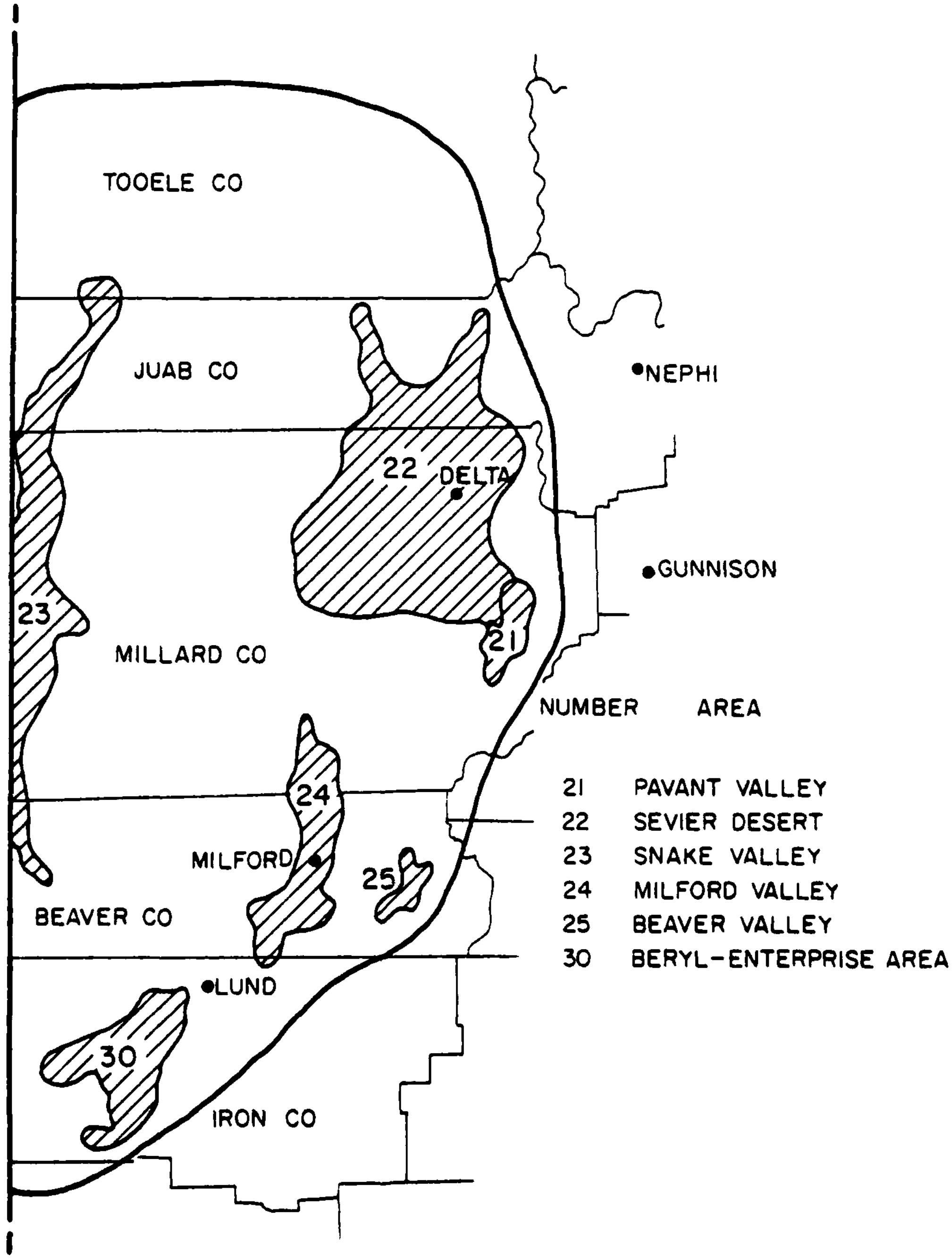

Figure A-2. Areas of major ground water development in the Eastern Great Basin.

Source: Lewis, W.C. 1979. Utah Water Law and Institutions. Economic Research Institute paper, August.

Zone 1-Central-West Central Iron County

Approximately 2000 MWe could potentially be produced in this zone from two sites, Beryl, Utah and near Cedar City, Utah. The production level assumes that sulfur dioxide, the main air pollutant, is controlled at the EPA and Utah Air Quality Board required 90 percent level. Under the most efficient wet cooling technology this production level would require approximately 22,040 acre feet of water annually which would have to be taken from the closed Cedar-Beaver hydrologic subbasin. This is the only groundwater subbasin in Western Utah where withdrawals exceed recharge and are causing groundwater mining in the area.

The indications are that production (based on air quality constraints) could go as high as 1500 MWe in the Beryl area or at a site near Lund, Utah, but production would be limited to 500 MWe or lower at a site near Cedar City. There are several large wells in the area the water from which is used for irrigation purposes. The few residents of Lund draw water from a small well inadequate for any expansion of water using industries such as electricity generation or a defense installation. Underground water supplies in the area are fairly large, but the quality of the water is unknown. Relatively expensive deep wells would be required to access this source.

Production at the 2000 MWe level would bring more than 330 people and their families into the area. Cedar City would probably be the main city absorbing the increased population. Approximately one-half of the culinary water used in Cedar City comes for natural springs. Additionally, four deep wells are used, particularly in the summer when heavy water use is in full swing. Approximately 3,100 acre feet annually is provided from the springs and the wells.

Zone 2-Milford-Black Rock Area

A potential power limit of 6000 MWe was determined for this area from coal-fired generation. Two sites were considered, viz., Black Rock in Millard County and Minersville in Beaver County. Production in each area could be approximately 3000 MWe beyond which air emission plume interaction would violate the Prevent Significant Deterioration (PSD) class II air quality constrant in the Bradshaw Mountain area to the east. A site at the Roosevelt KRGA could be an alternative to the Black Rock site and has the advantage of possible hybrid coal-geothermal generation.

A power production level of 6000 MWe for the Milford, Minersville and Beryl area would use 66,120 - 78,000 acre feet of water depending on the cooling technology (assuming wet cooling). At those levels, acreage would be withdrawn from irrigation starting with pastureland and then withdrawal of cropland (Glover and Keith, 1979).

Milford, Utah would be the main town effected by this expansion. Rights are perfected to a diversion of 3,200 acre feet from three working wells and another three which could augment supply. Milford has been preparing for a number of years for future development expected from an alunite complex some 30 miles w ·thwest of town. Water storage is being expanded and a seventh well is ·der development.

Sulfurdale, north of Milford is a very small community where some mining and a relatively small farming activity exists. A natural spring serves the mine with approximately 320 to 480 acre feet per year. Water for expansion of water using industries is quite limited in this area.

Some data from well driller reports (Mower and Cordova, 1974) give indication of the ground water situation in the Sulfurdale area (Table 1).

Table 1

Ground Water Conditions for the Cove-Sulfurdale, Utah Area

Location	Well Diameter (inches)	Depth of Well (feet)	Depth to Water (feet)	Flow (gpm)	Drawdown (feet)	Flow perfect of drawdown (gpm/feet)
(c-25-7)24 bac	8	920	a/	15	a/	a/
(c-25-7)26 bdd	8	400	130	250	110	2.3
(c-25-7)26 dac	10	436	123	150	110	1.5
(c-25-7)26 dac	8	426	125	150	100	1.5
(c-25-7)26 dcc	8	255	70	25	40	0.6
(c-25-7)36 aca	12	390	80	a/	a/	a/
(c-25-7)26 ada	12	385	105	a/	a/	a/
(c-25-7)26 bdc	8	250	170	20	5	4.0
(c-25-7)36 bad	6	202	a/	12	a/	a/
(c-25-7)36 bda	12	246	90	430	140	3.1
(c-26-7)12 a	12	602	400	380	a/	a/
(c-26-7)14 add	8	340	226	100	20	5.0

a/ Data unavailable

Source: Mower, R.W. and R.M. Cordova. 1974. Water Resources of the Milford Area, Utah, With Emphasis On Ground Water. Utah State Department of Natural Resources Technical Bulletin No. 43.

It has been estimated that cold water natural sprngs that existed in the area prior to development of wells discharged between 60 and 90 gpm (100-150 acre feet) annually.

A possible 3000 MWe coal-fired generating plant would require upwards to 40,000 acre feet of water annually for cooling. Since the flow in the Milford valley is to the north, needed ground water might be obtained from appropriation of ground water that has moved northward

beyond the agricultural area in the valley. The ground water apparently moves out of the valley past Black Rock and enters Pavant Valley and then flows north-northwest into the Beaver River drainage. The water needs for cooling exceed the discharge from the Milford Valley, but depletion of ground water resources away from the agricultural area might be acceptable to the State Engineer. It is evident, however, that such large developments as coal-fired electric generation, or other complexes, could more cheaply obtain water from already developed ground and surface water sources in the Cedar-Beaver drainage system.

About 5 to 8 miles west of Kanosh in the Pavant Valley, the ground water is extremely saline (up to 4,000 mg/l). It appears that the ground water is affected by the north bearing faults which run from the Cove Fort-Sulfurdale geothermal area northward into the Pavant Valley west of Kanosh. Ground water to the east, closer to Kanosh, is of better quality. In fact the poor quality water appears to run along the direction of the fault from the geothermal area to Clear Lake and on to the very saline thermal springs some 20 miles north of Delta.

Zone 3-Northeast Millard County

In this area, the Intermountain Power Project (IPP) coal-fired electricity generating complex is currently planned for development to the 3000 MWe level. Rights for approximately 35,000 acre feet of water now used for irrigation are being purchased from local canal companies.

Some plume interaction modeling completed for the Utah Consortium for Energy Research and Education study (Wooldridge, 1979) suggests that the northeast Millard County air shed is relatively open with adequate air dispersion characteristics for coal-fired power generation. Even after the 3000 MWe IPP complex is in existence, some 5600 additional MWe

could be developed at another site in the area such as at Soap Wash or in the McCornik-Greenwood area before PSD class II standards would be violated assuming 90 percent sulfur clean-up at each generating site. Substantial additional water transfer from irrigation would have to take place to meet the cooling requirements for the amount of electricity generation. The total requirements would be in the neighborhood of 100,000 - 130,000 acre feet of water depending on the cooling technology. This compares to total irrigation water rights in Millard County of less than 300,000 acre feet.

Most of the water supply to the lower Sevier hydrological subbasin, where Zone 3 is located, is from the Sevier River. The river drains some 43,000 square miles. Most of the flow occurs during the spring snowmelt period, and the 236,000 acre-foot Sevier Bridge Reservoir helps to stabilize the yearly supply.

Winter and early spring flows into the river below the Sevier Bridge Reservoir are diverted to the offstream Fool Creek Reservoir which has a capacity of 10,000 acre feet. Downstream from this reservoir the Sevier River is impounded in the 11,000 acre Delta-Melville-Abraham-Desert (DMAD) reservoir. Still further downstream, water is also impounded in the Gunnison Bend reservoir west of Delta which has a 4,550 acre foot storage capacity.

Eight wells have been developed by the DMAD irrigation companies adjacent to the Sevier River between the Central Utah Canal diversion and the DMAD reservoir. The water from the wells is pumped directly into the river and augments the Lower Sevier supply by approximately 14,000 acre feet annually. The main purpose of the wells is to provide fresh water to dilute the salt content of the lower Sevier River as autumn flows are too saline for irrigation use.

Zones 6 and 7-Western Juab County and Snake Valley

An electricity production limit of 2800 MWe was derived from the UCERE evaluation for Western Juab County in the Fish Springs Flat area. Cooling water would have to come from springs and ground water sources in the area. Approximately 2500 MWe was derived from the air quality standards in Snake Valley. Here also, water would have to come from ground water sources.

Little is known about the yield of ground water in these two areas. Ground water exists and apparently recharge exceeds withdrawals in the hydrological subbasin whithin which both areas are located. However, the development of the ground water might be an expensive proposition and these two zones are much less favorable areas for electric power than zones closer to the Sevier River drainage system.

Some economic modelling has been done by Glover and Keith (1979) to compare the economic feasibility of electric power generation in the seven zones shown in Figure A-1 in the Great Basin of Utah in light of various physical and environmental constraints. The most feasible zones are Milford-Black Rock, Northeast Millard County, Eastern Juab County, and Sanpete-Sevier county. With a gate price (a price at the distribution breakout point but not including delivery or delivery costs) of $30/MWh, production in Northeast Millard County would be limited to 3400 MWe, just 400 MWe over the proposed IPP level. Production in the Milford-Black Rock area would be limited to 2600 MWe.

At the most efficient water use levels in coal-fired plants, water requirements would be 37,470 acre feet and 28,650 acre feet in respectively the Northeast Millard and Milford-Black Rock areas. The least expensive

source would be purchased from agriculture. The first sales have been of water consumed in wetlands and pastureland in the Milford-Black Rock area while sales by farmers cutting back to partial irrigation take place in the Delta area. Marginal land is moved out of production (and is not irrigated of course) in both areas. The economic modelling indicates that, in Delta, almost 40 percent of the alfalfa acreage becomes partially irrigated as the power production increases to the 2400 MWe level.

APPENDIX B

ELECTRIC TRANSMISSION LINES

Remote desert sites are being favored for construction of electric power generating plants because of their advantage in meeting air quality standards. High voltage transmission lines, however, are required to wheel the power to market at load centers in distant cities. In recent years, all major power plants and load centers have been interconnected with power lines so that a given generating capacity could go further by taking advantage of the diversity in demand schedules among load centers.

The existing and proposed generating sites in the MX missile study area and elsewhere in the Great Basin are or will, when constructed, be connected into this grid of interconnected transmission lines. One problem in plant siting is that because of the many small mountain ranges, long straight corridors are limited in the Great Basin. Transmission lines are longer as they go around mountains and other natural obstacles.

The major power transmission corridors in western Utah are southwestward from Salt Lake City to Las Vegas and westward from Delta to Ely. Power generated by the Intermountain Power Project would largely be transmitted to California over lines following the first of these two corridors to Las Vegas and on to Victorville, California. The major current and prospective routes as compiled by the Western Systems Coordinating Council (1979) are shown on Figure B-1.

Two alternate routes are being considered for transmission from the IPP plant to Las Vegas as show on Figure B-1. The western of the two routes is 468 miles long or 10 miles longer than the more eastern route.

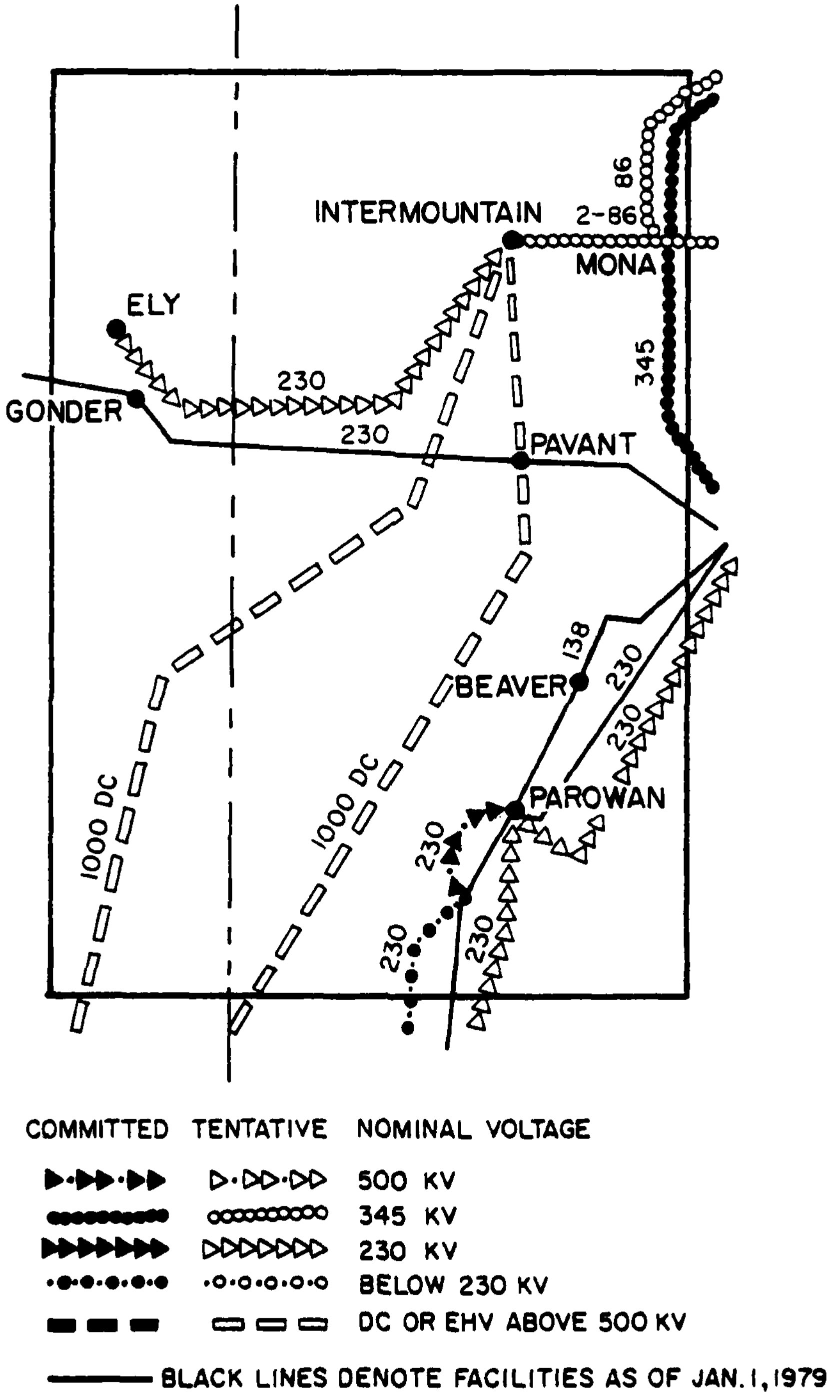

Figure B-1. Existing and planned transmission systems.

The tower system, access road configuration, and right-of-way requirements depend on the transmission line capacity and whether transmission is by direct or alternating current. For direct current transmission, land used per mile of line ranges from 21 acres/mile for a 500 kv system to approximately 19 acres/mile for 1000 kv systems with the exact requirements depending on the tower configuration. For high voltages (1000 kv) an alternating current system requires more land than does a direct current system because of the tower and compensation stations invovled. A 500 kv a.c. system requires only approximately 15 acres per mile, however, and 345 kv and 230 kv transmission require only about 11 and 9 acres/mile respectively. The two proposed IPP transmission lines, which are 500 kv d.c. systems eminating from the IPP complex at Lynndyl, Utah and running to Victorville, California, are estimated to require about 20 acres/mile.

Both the western and southwestern routes from Lynndyl to California run, for the most part, through existing transmission line corridors while crossing Nevada and California. In Utah, the western route follows new corridors through Millard, Beaver, and Iron Counties, but the southwestern line runs via an existing corridor throug Washington County.

Another corridor connects power production in northeast Millard County to Nevada via the Gonder substation near Ely, Nevada. A proposed new substation in the Milford-Black Rock area would play a major role in expansion of transmission capacity from the Great Basin to California.

Consultations were held with Bureau of Land Management personnel in both Utah and Nevada and with electric utility representatives to delineate the probable new transmission corridors associated with the various desert generating locations under consideration. One possible corridor

would originate in northern Box Elder County, follow a new route into Elko County, Nevada, near Montello and then run southward to the Gonder substation near Ely, Nevada. From this point the line would proceed south into Lincoln County and connect into the western route to California via Pioche, Las Vegas and on to Victorville. Considerable mileage could be cut from this route if it were possible to come directly south from Lucin and connect into the western route corridor in western Millard County. However, the defense installations and gunnery range on the Salt Flats in Tooele County block this path.

Most of the land over which the proposed transmission systems cross is under federal jurisdiction, and at several locatios, possible conflicts with alternative uses must be settled. One of the principle issues relates to locations where the transmission line-potential wilderness area interface is sensitive to changes in line capacity, land use for the lines, and line visibility.

The Howell Peak, Notch Peak, King Top and Couger Mountain locations have potential for wilderness areas. Both the Gonder substation route of the Utah Transmission System and the western route of the California system out of Millard County pass around these areas. These lines would also pass around the wilderness areas east of Ely such as Mt. Moriah, Wheeler Peak, Fortification Range and other areas. There are several recreation and scenic view attractions in these same areas as well as in the Beaver, Iron and Washington County corridors through which the southwestern route to California passes. While these electric energy transmission corridors do not use water directly, they are important linkages in determining the total development and hence water use in the area. Care must be taken to avoid conflicts between the transmission facilities and the MX system.

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